

STUDENT NAME: A41986100  
Version B

GROUP: C1

90

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- C 1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- B 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- D 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
- B 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- B 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- A 6. Which of the following would cause the acidity of Earth's oceans to decrease? Cold ↑
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- The reservoir will eventually disappear.
  - ☒ The reservoir is not in equilibrium.
  - The reservoir is growing smaller.
  - The reservoir's residence time is 10 years.
- B 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- The Earth's atmosphere would become colder than it is today.
  - ☒ The Earth's atmosphere would become warmer than it is today.
  - The Earth's atmosphere would remain about the same temperature as it is today.
  - The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- A 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ Reflection of more solar radiation, causing atmospheric temperature to decrease
  - Reflection of more solar radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- B 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

☁ → ↑ energy → ↑ temps



**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

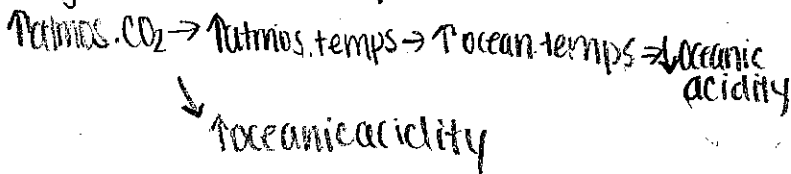
Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

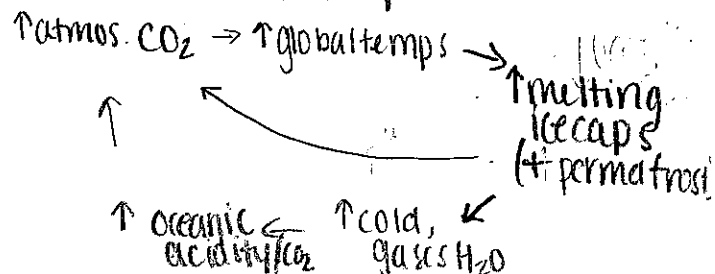
25

Systems are naturally attempting to reach an equilibrium. An example of this would be the equilibrium being reached between atmospheric and oceanic  $\text{CO}_2$  levels. In it's efforts to reach equilibrium, the ocean would become slightly more acidic. The process is as follows: increased  $\text{CO}_2$  concentration in the atmosphere would cause increased global temperatures due to the greenhouse effect. (The warmer atmospheric temperatures would also warm the ocean.) As the  $\text{CO}_2$  concentration in the atmosphere increased, it would cause dissolution of the  $\text{CO}_2$  into the ocean, increasing acidity. The increased acidity would then be adjusted as  $\text{CO}_2$  was released back into the atmosphere due to the increased ocean temperatures. (Higher water temperature cause a lower amount of dissolved gases in the ocean.)

**Negative Feedback Loop:**



**Positive Feedback loop**



In the end though, acidity of the ocean would increase as compared to previous oceanic acidity levels, but only slightly.

A positive feedback from this process would be that as atmospheric  $\text{CO}_2$  levels increased, global temperatures increase, which causes cold, polar water to melt into the oceans, causing an increase of dissolution of  $\text{CO}_2$  into the oceans because, once again, colder water retains more gases. As the ice continues to melt, and permafrost melts, albedo will be decreased and more  $\text{CO}_2$  will be released, once again increasing temperatures, melting ice, and increasing ocean acidity.

ice to melting icecaps

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

An increase in volcanism would cause a decrease in the greenhouse, and because of this, a decrease in global temperatures.

The sun emits radiation to Earth in the form of visible light. This visible light is absorbed at the Earth's surface and reradiated in the form of infrared radiation. Greenhouse gases in the atmosphere ( $\text{CO}_2$ , methane, water vapor) are not able to absorb the visible light, but are able to very successfully absorb infrared radiation reradiated by the Earth. The gases absorb the radiation and emit the heat which warms the atmosphere (the greenhouse effect).

When bright surfaces are present to reflect the visible light from the sun before it is able to be absorbed by the Earth's surface, it is called albedo. Substances that increase the albedo effect would be ice caps, glaciers, clouds, and in this case, ash in the atmosphere.

By increasing the amount of ash in the atmosphere, more and more visible light is being reflected back into space before it has the chance to be absorbed, reradiated, and trapped by greenhouse gases. Therefore, increased volcanism would decrease global temperatures.

Extra credit (2 points).

How are evaporation and degassing similar and/or different? Both release gases into the atmosphere. Evaporation releases water vapor into the atmosphere while degassing most often oxygen or  $\text{CO}_2$ . They both gain gravitational potential energy as they go from the surface to the atmosphere.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

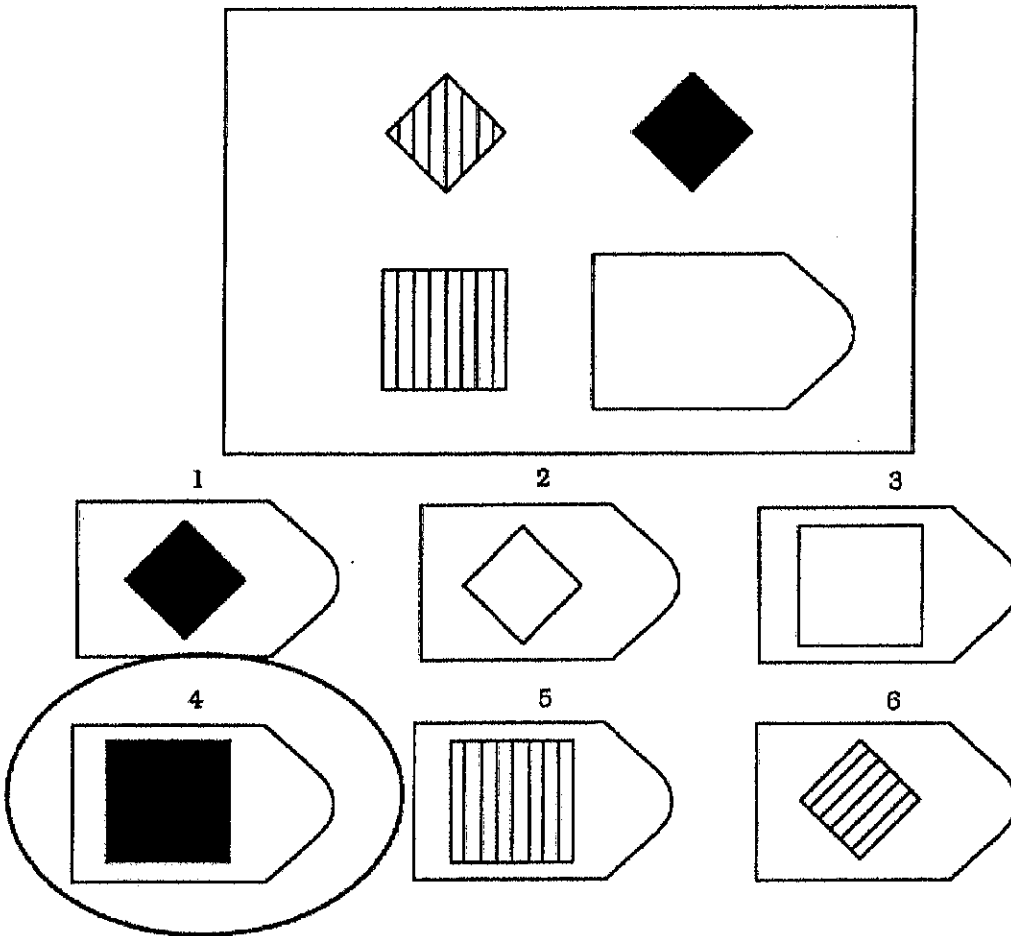


# Analogical Assessment

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*Example*

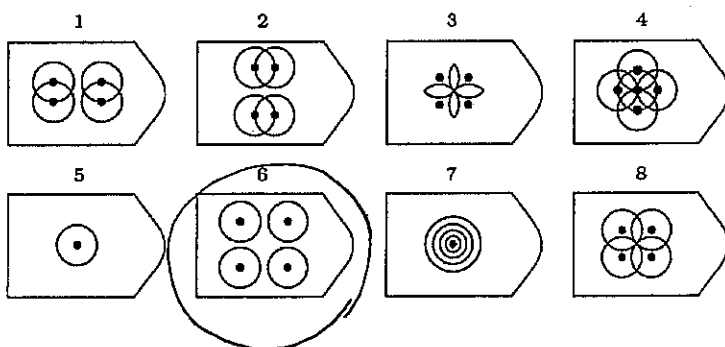
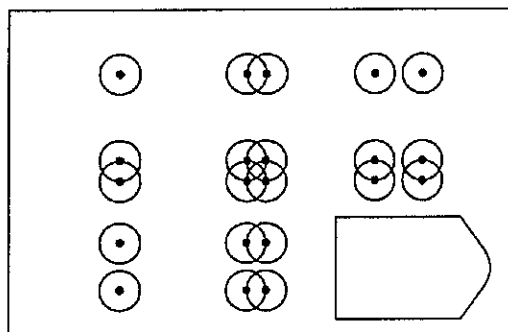


**Answer: 4**

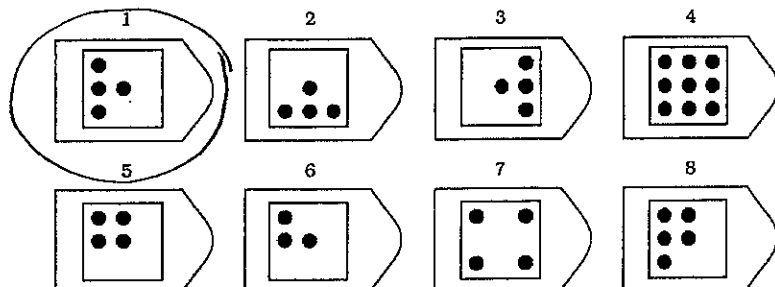
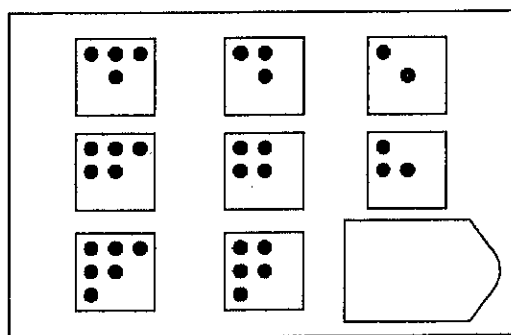
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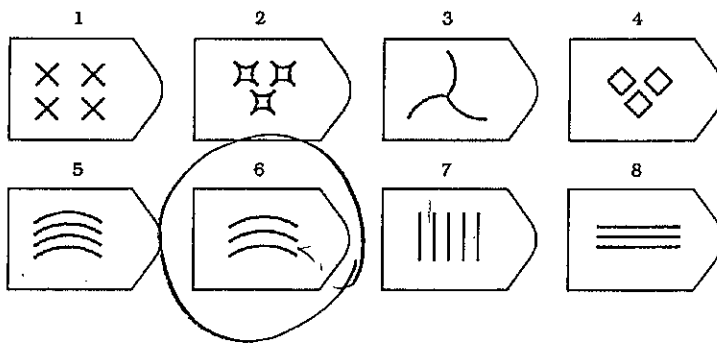
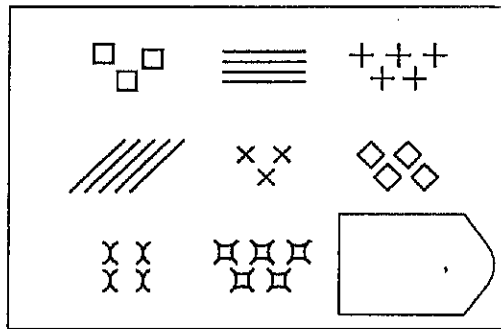
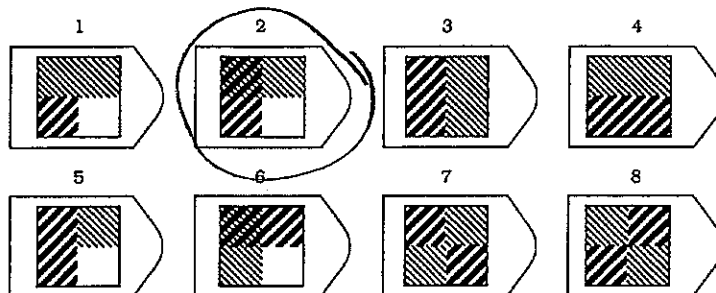
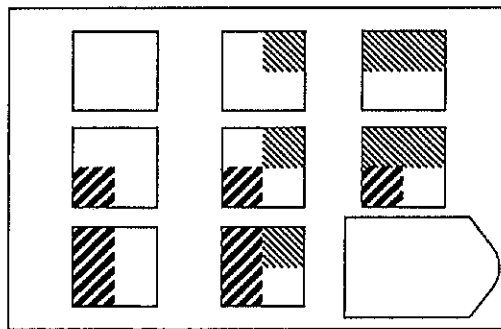
Please choose the image that best completes each of the following patterns.

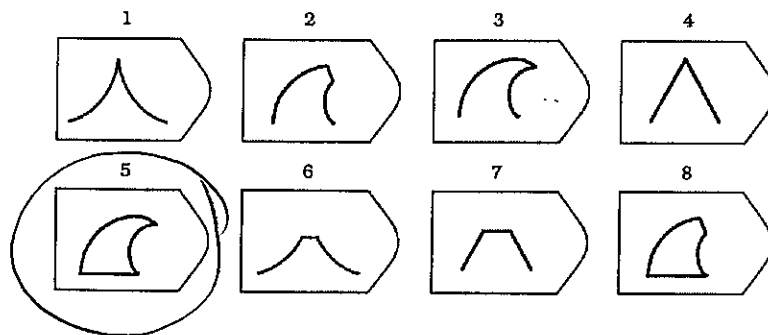
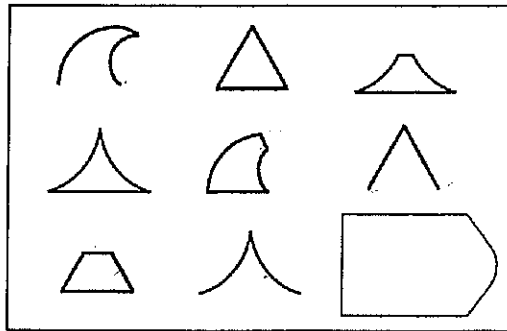
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.
- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
  - ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
  - C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
  - D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.
2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week
- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
  - B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
  - C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
  - D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.
3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.
- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
  - ☒ B. Bob was able to maximize his work time by cutting back on watching TV during the day.
  - C. Sean has been closely monitoring his eating in an attempt to improve his diet.
  - D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.
4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.
- A. After eating a big lunch, Dan went back to his office and took a nap.
  - B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
  - ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
  - D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- ☒ D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48142

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A41914545  
Version B

GROUP: C1

55

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
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2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
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- ✓ 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
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  - ☒ a. Human activities are the primary cause of the greenhouse effect.
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5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
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2A. B
6. Which of the following would cause the acidity of Earth's oceans to decrease?
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7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
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8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990-rates?
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9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
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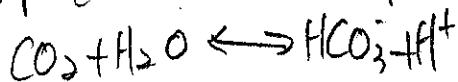
SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

a. In the atmospheric carbon dioxide have many different way to solve. For example, tree and ocean. Most of carbon dioxide solve to ocean. First step is  $\text{CO}_2$  is going to the atmosphere from surface such as car, coal and natural stuff. When it goes up, naturally it can touch to ocean or combined to precipitation and go to the ocean.



When it combined with water, ~~this~~  $\text{CO}_2 + \text{H}_2\text{O}$  is combination. and after it solved to ocean is  $\text{HCO}_3^- + \text{H}^+$ .

B. This is positive feedback because when atmospheric carbon dioxide increase in atmosphere, it's positive feedback and also. When it affect ocean acidification, inside of ~~atmosphere~~ rate of ocean's  $\text{HCO}_3^- + \text{H}^+$  is increasing. Both sides are increasing it means it atmosphere - ric  $\text{CO}_2$  is increasing, oceans have to solve more  $\text{CO}_2$  that is why it is positive effect.

? 10

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Volcanism on Earth suddenly increase and large ash clouds are in the atmosphere. The temperature of atmosphere will increase because ash clouds are blocked ~~incoming~~ <sup>reflecting</sup> radiation so the temperature will go up. It can explain Green house effect. (Green house effect mean is ~~Carbon dioxide rate increase in the atmosphere so <sup>ref</sup> radiation cannot go into space. It cause to increase earth's temperature.~~ atmosphere blocked by carbon dioxide and solar energy cannot go into space so the solar energy stay in the earth.)

5

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

These two are similar. Evaporation is increasing temperature so molecular vibrating is increasing and degassing is pressure is decreasing so molecular ~~is~~ vibrating is increasing.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

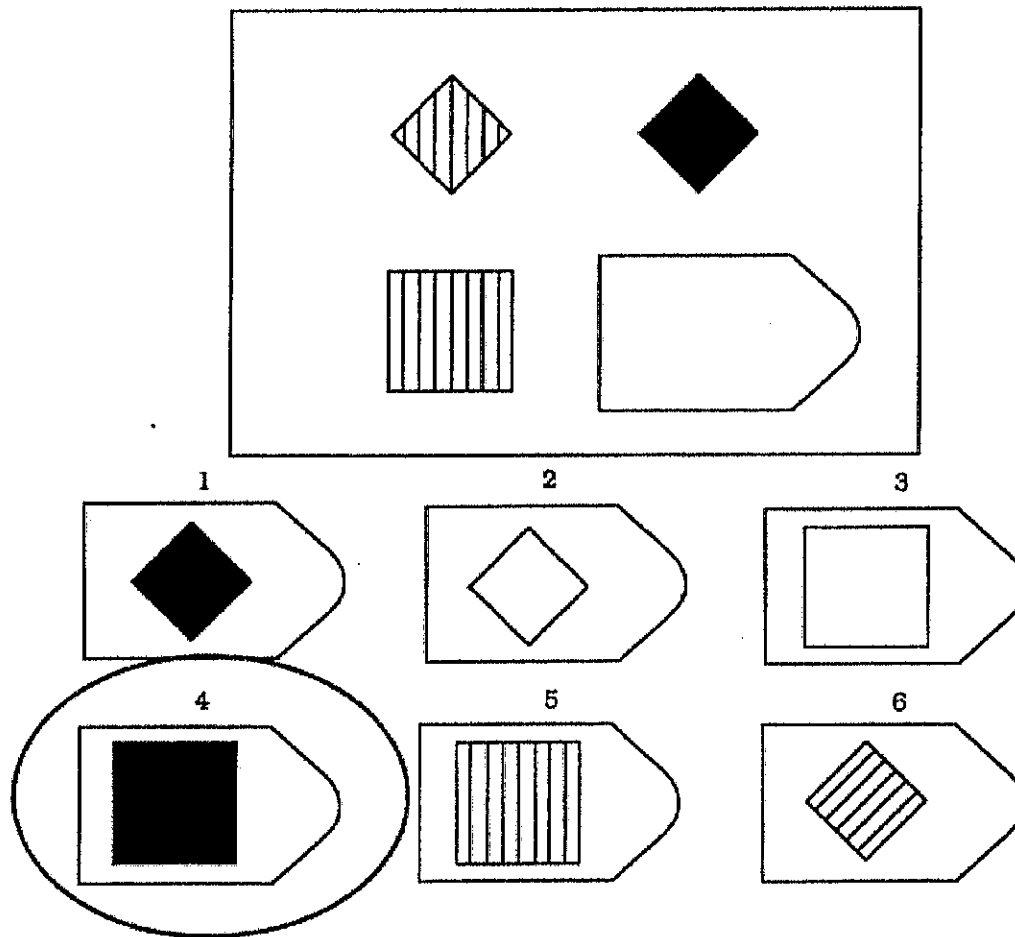
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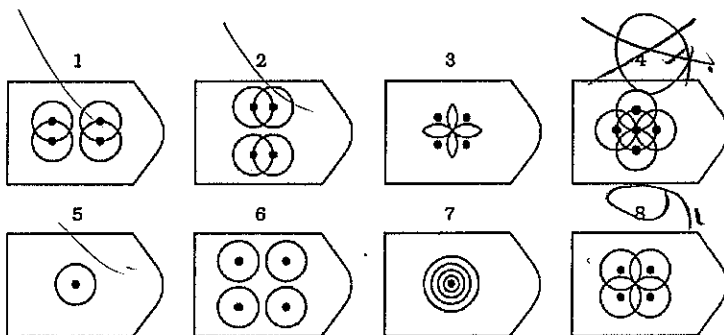
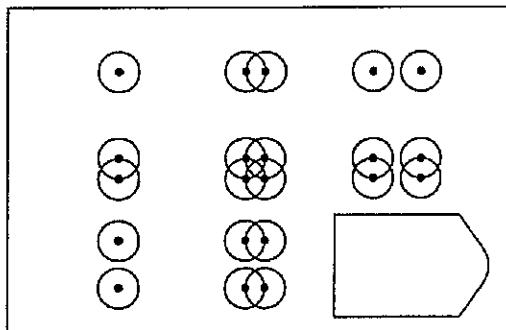


**Answer: 4**

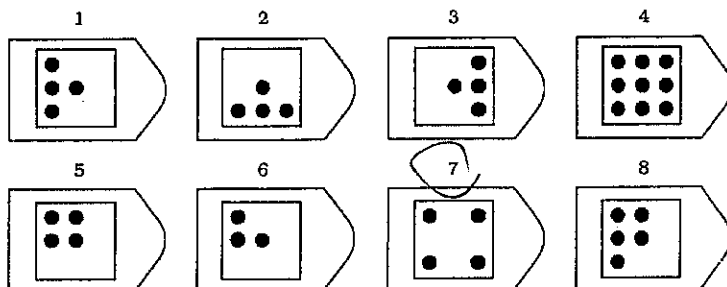
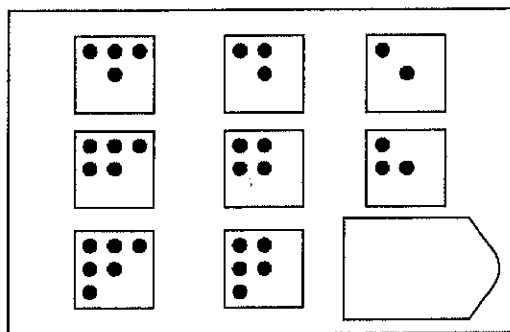
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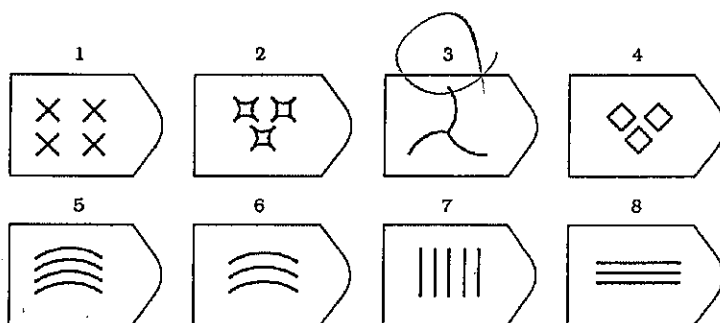
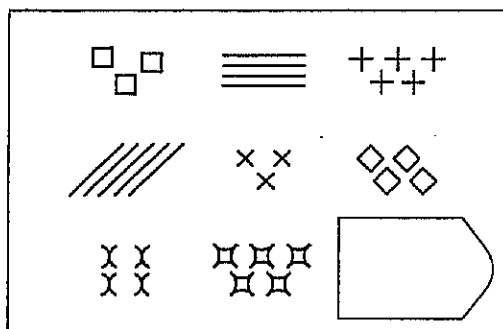
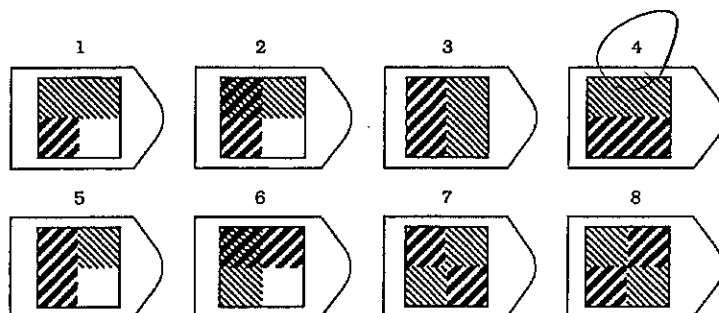
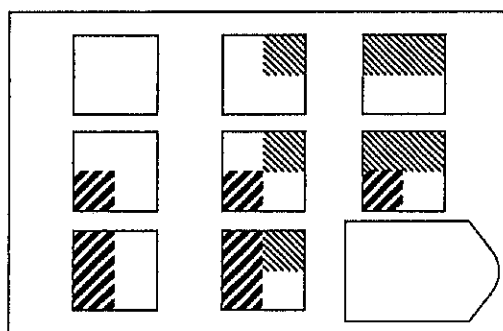


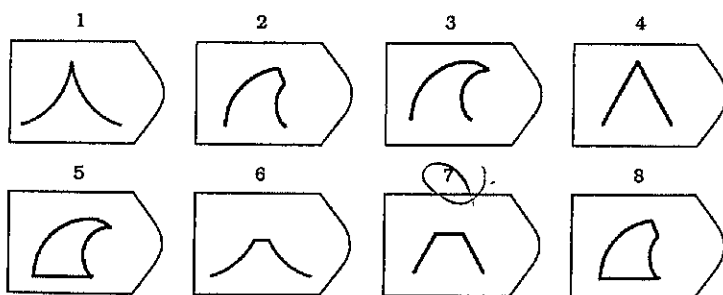
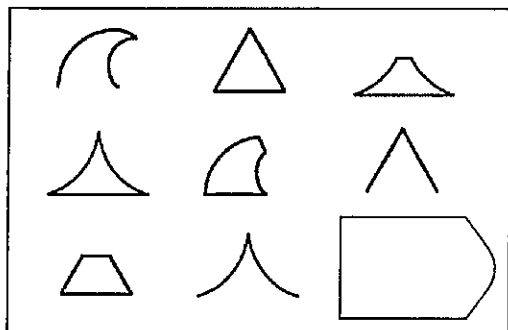
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

**PATTERN 5**

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**Example**

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- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- ☒ A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.

B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.

☒ C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.

D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

---

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

☒ A. Getting high. They are both involve too much of a chemical influencing the body.

B. Hitting your head. They both involve something that causes headaches.

C. Being sleep deprived. They both involve impaired functions.

☒ D. Eating too much candy. They both involve lack of self-control.

E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

A. Dew forming. They are similar because they both involve a drop in temperature.

☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.

C. Clouds forming. They are similar because they both involve a phase change.

D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 25 years

What is your home zip code? 48823

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☐ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☒ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 401 758 20  
Version B

GROUP: C1

82

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- D. a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
b. Melting of permafrost resulting in more methane escaping into the atmosphere  
c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- B. a. The magma becoming colder ×  
b. Gas bubbles forming in the magma  
c. The surrounding crust becoming hotter ×  
d. Crystals forming in the magma ×
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A. a. A= erosion, B= deposition, C= uplift and erosion  
b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- A. a. Human activities are the primary cause of the greenhouse effect.  
b. Natural processes are the primary cause of the greenhouse effect.  
c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect. ×  
e. The human and natural causes of the greenhouse effect are not understood. ×
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- B. a. Reservoir A has a shorter residence time than Reservoir B.  
b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- A. a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide. °  
b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

- A.** A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- D.**
- a. The reservoir will eventually disappear.  $\times$
- b. The reservoir is not in equilibrium.  $\times$
- c. The reservoir is growing smaller.  $\times$
- (d.)** The reservoir's residence time is 10 years.
- 8.** What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- A.**
- (a.)** The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- 9.** Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A.**
- (a.)** Reflection of more solar radiation, causing atmospheric temperature to decrease.
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- 10.** Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- B.**
- (b.)** More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

$$\begin{array}{r} 1000 \\ 100 \\ \hline 10 \end{array}$$

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

25

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

OCEAN ACIDIFICATION IS DUE TO AN INCREASE IN  $\text{CO}_2$  IN THE OCEANS. THE  $\text{CO}_2$  COMBINES WITH  $\text{H}_2\text{O}$  TO FORM BICARBONATE IONS AND HYDROGEN IONS. THIS INCREASES THE PH LEVEL AND THUS CREATES AN ACIDIC ENVIRONMENT. ( $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$ ) WHEN  $\text{CO}_2$  IS INCREASED IN THE ATMOSPHERE, THROUGH EQUILIBRIUM,  $\text{CO}_2$  MUST ENTER THE OCEAN THROUGH DISSOLUTION. THERE IS CONSTANTLY MOVEMENT OF  $\text{CO}_2$  IN AND OUT OF THE OCEAN/ATMOSPHERE TO CREATE THIS BALANCE. IT'S NOT ALWAYS SO CLEAR CUT THOUGH BECAUSE OF POSITIVE AND NEGATIVE FEEDBACK LOOPS, AN INCREASE IN ATMOSPHERIC  $\text{CO}_2$  WILL INCREASE THE TEMP. ON EARTH AND IN THE OCEANS, BUT WARMER WATER ~~HOLDS~~ HOLDS LESS  $\text{CO}_2$  THAN COLDER WATER SO THIS COULD POSSIBLY MAKE THE WATER LESS ACIDIC, AND IS A NEGATIVE FEEDBACK. A POSITIVE FEEDBACK WOULD BE MORE  $\text{CO}_2$  LEADING TO MORE ACIDITY, THE INCREASE IN  $\text{CO}_2$  IN THE WATER IS DUE TO AN INCREASE IN  $\text{CO}_2$  IN THE ATMOSPHERE. WHEN THE  $\text{CO}_2$  BREAKS APART IT MAY ALSO BOND WITH  $\text{Ca}$  TO FORM  $\text{CaCO}_3$ . WHEN THIS IS COMPACTED INTO THE OCEAN FLOOR, EVEN MORE  $\text{CO}_2$  WILL NEED TO ENTER THE OCEAN TO REPLACE IT.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

IF VOLCANISM INCREASED ON EARTH THERE WOULD BE A LOT OF CHANGES. AN INCREASE IN VOLCANIC ASH IN THE ATMOSPHERE WOULD CAUSE GLOBAL COOLING AND GLOBAL WARMING. WHEN VISIBLE LIGHT ENTERS THE ATMOSPHERE IT IS USUALLY ABSORBED INTO THE GROUND AND ~~RE-REFLECTED~~ EMITTED AS INFRARED ENERGY. THIS ENERGY IS THEN MOVED INTO THE ATMOSPHERE WHERE IT EITHER ESCAPES OR IS CAPTURED BY GREENHOUSE GASES ( $\text{CO}_2$ , METHANE + WATER VAPOR) AND THEN RE-RADIATED BACK TO EARTH WHERE THE PROCESS OF RE-ABSORPTION AND RADIATION CONTINUES. THIS CAPTURED EFFECT OF IR HEAT IS LIKE A GREENHOUSE. IF ASH IS IN THE ATMOSPHERE IT WILL ACT LIKE A GHG AND CAPTURE AND RE-EMIT HEAT ALREADY IN THE ATMOSPHERE. IT IS HARD TO SAY THOUGH IF THIS WILL CAUSE WARMING BECAUSE AT THE SAME TIME VISIBLE LIGHT CAN ENTER THROUGH THE ASH AND INTO THE ATMOSPHERE. VOLCANISM INCREASING THROUGHOUT THE PAST THOUGH HAVE SEEN AN INCREASE IN TEMP, BECAUSE

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

EVAPORATION IS THE PROCESS OF CHANGING A LIQUID INTO A GAS. DEGASSING IS THE RELEASEMENT OF  $\text{CO}_2$  FROM THE OCEAN TO THE ATMOSPHERE. VOLCANOES RELEASE  $\text{CO}_2$ . A LOT OF ENERGY IS USED AND RELEASED TO CREATE VOLCANIC ERUPTIONS.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

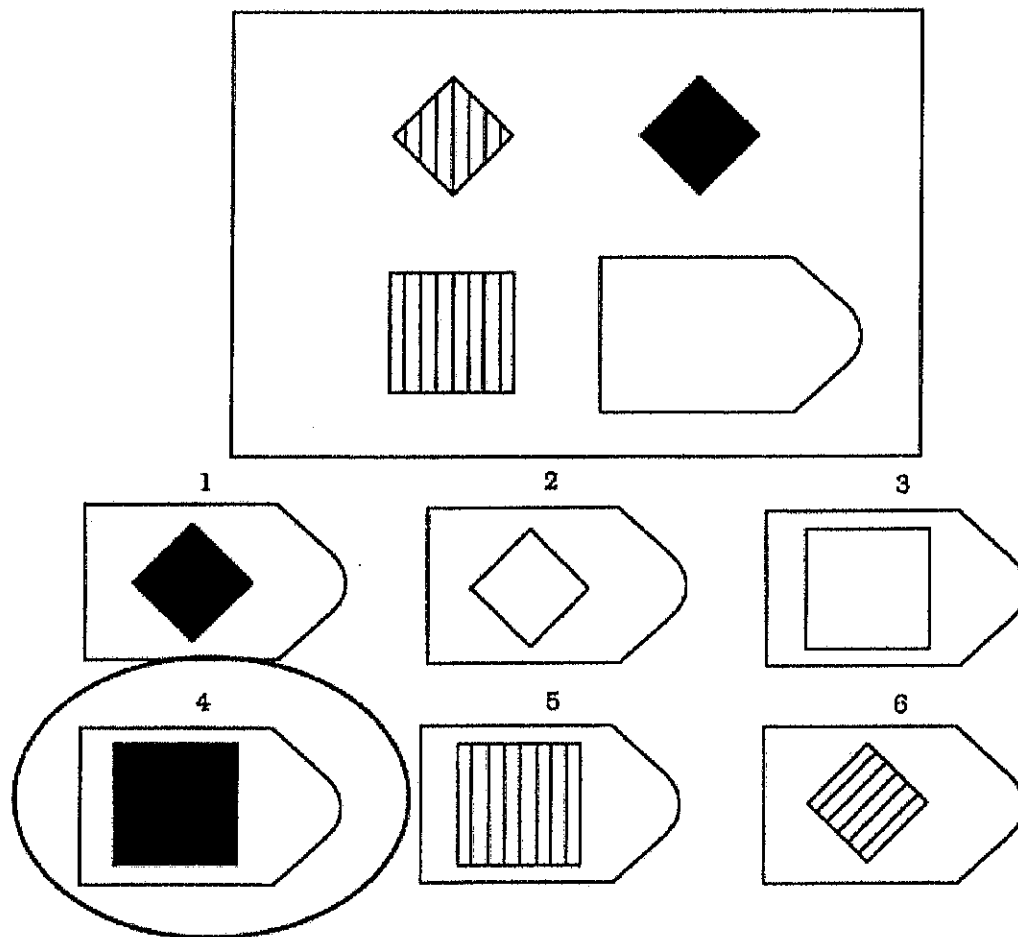


# Analogical Assessment

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In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

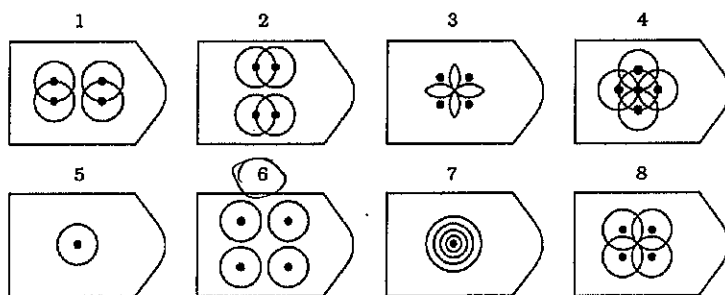
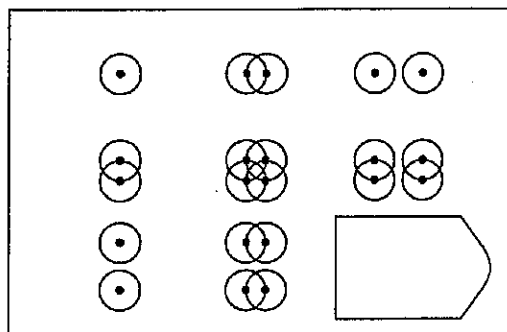


**Answer: 4**

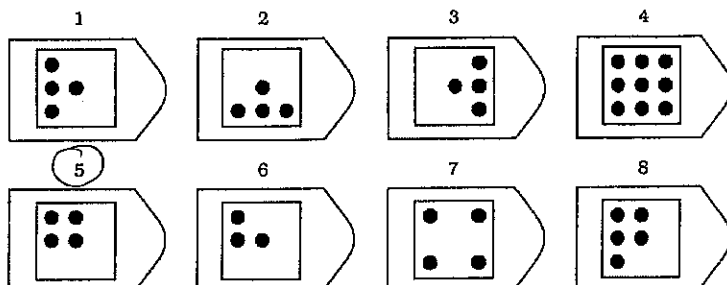
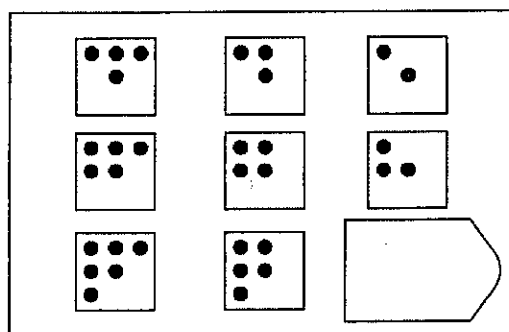
PLEASE CONTINUE ON NEXT PAGE

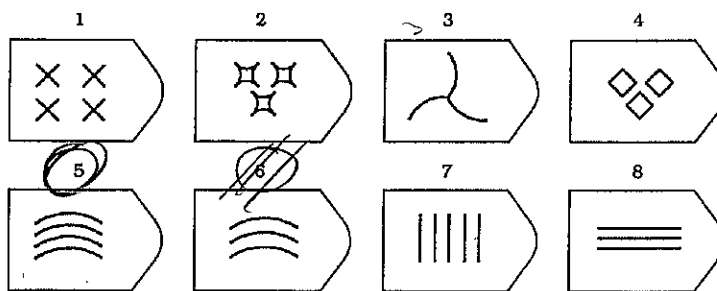
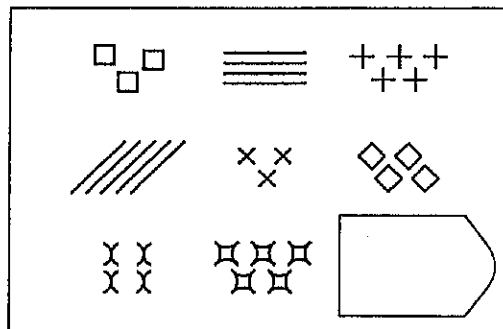
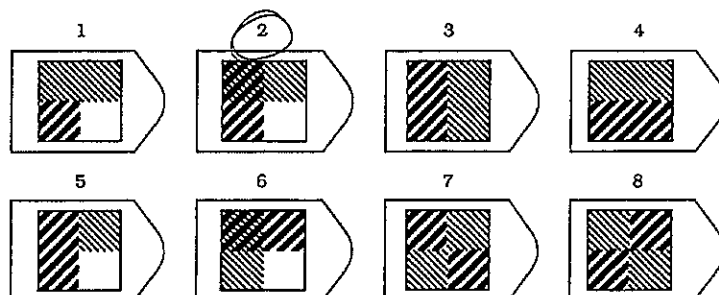
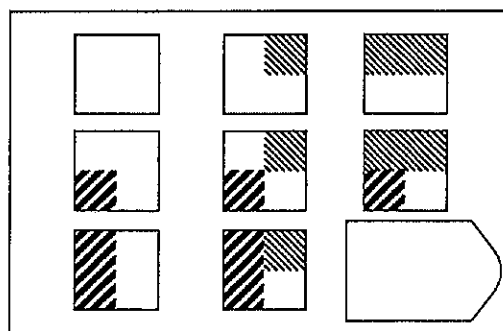
Please choose the image that best completes each of the following patterns.

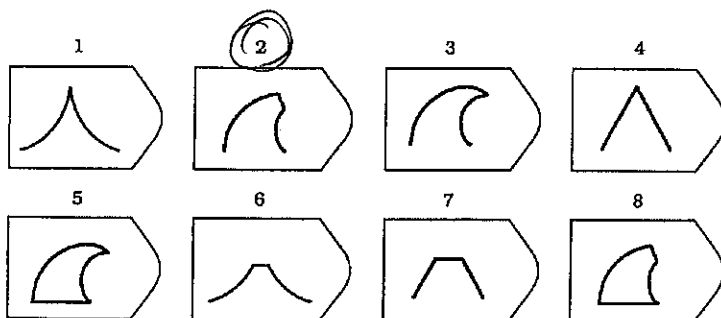
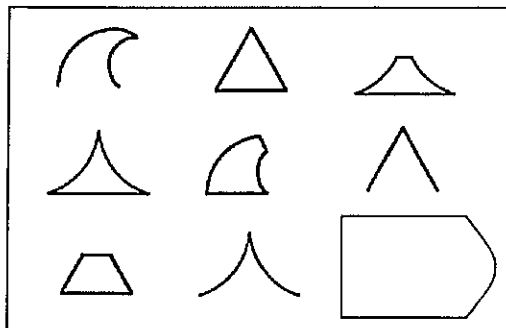
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48374

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



STUDENT NAME: A427729B1  
Version B

GROUP: C1

87

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A = erosion, B = deposition, C = uplift and erosion
  - b. A = erosion, B = biochemical precipitation, C = uplift and deposition
  - c. A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - d. A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect. Industrialization. Cars etc...
  - b. Natural processes are the primary cause of the greenhouse effect. Minimal
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- |   |   |
|---|---|
| A | B |
| 4 | 2 |
| 2 | 2 |
- 2/year    1/year
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- Even though increasing CO<sub>2</sub> in the atmosphere increases oceanic acidity, cold water is going to absorb the CO<sub>2</sub> more. Blocking solar radiation doesn't change the amount of CO<sub>2</sub> in the atmosphere.

7. A reservoir is 1000 km<sup>3</sup> in size, has an influx of 100 km<sup>3</sup>/year and an outflow of 50 km<sup>3</sup>/year. Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

$$\frac{1000}{150} = 6.67$$

Not in equilibrium since the outflow is less than inflow. The size will increase.

☒ 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease Positive Feedback
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

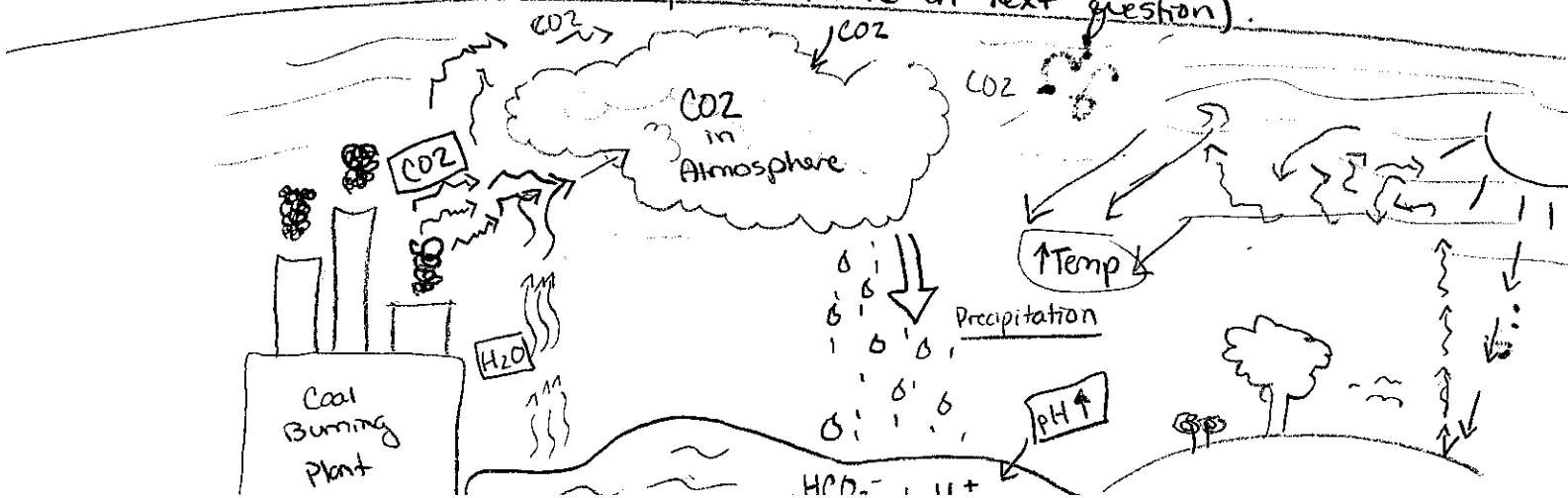
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25

Ocean acidification is the process by which the pH levels of ocean water are increased due to an increased level of  $\text{CO}_2$  in the atmosphere. As levels of  $\text{CO}_2$  increase in the earth's atmosphere, they precipitate into oceans which directly increases the pH levels in the oceans. As the water contains more  $\text{CO}_2$ , this carbonated water cycles through the water cycle via evaporation, condensation, and precipitation, continuously increasing the levels of pH in the oceans, increasing acidity. This is a positive feedback loop. Conversely,  $\text{CO}_2$  in the atmosphere is what causes greenhouse gases. This, in turn, reduces acidity in oceans because it warms the water and warm water can hold less  $\text{CO}_2$  than cold water. If we imagine that a volcano has erupted, the ash would cover the atmosphere preventing the atmospheric temperature to increase. This would cause the ocean temperatures to decrease, increasing its ability to store  $\text{CO}_2$ . As the ash fell from the atmosphere, this would increase  $\text{CO}_2$  in the oceans as well as acidification; however once the ash was gone, the temperature of the water would increase again, so the ocean wouldn't be able to hold as much  $\text{CO}_2$ . This is a negative feedback loop. (Volcanism explained more on next question).



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Increased volcanism and increased ash found in the atmosphere will decrease temperatures of the earth's atmosphere. When there is a large amount of volcanic ash in the atmosphere, the visible light from solar rays is prevented from entering past the earth's atmosphere. Unlike the greenhouse effect, these rays of visible light never reach the earth's surface to be re-emitted as infrared or "heat" rays. Through the process of the greenhouse effect, greenhouse gases do not absorb visible light rays; however they do absorb infrared rays that have been re-emitted after reaching the earth's surface. As these heat rays re-enter the atmosphere, they are absorbed by the greenhouse gases instead of going into space. Then, they are essentially "spit-out" in different directions, be re-emitted by the earth's surface again and again. This is why we experience global warming. Unlike this process, increased volcanism prevents any visible light to pass through the atmosphere. This is why during increased volcanism, atmospheric temperatures would decrease. There would be no heat-rays being created to warm the earth. Luckily, the ash doesn't stay in the atmosphere forever but it does accumulate on the surface increasing CO<sub>2</sub> in oceans.

25

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is different than degassing. Evaporation is when water becomes water vapor which is a gas and it is transferred into the atmosphere. Degassing does not involve a phase change. It is simply when gas is released from a substance. (such as magma)

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

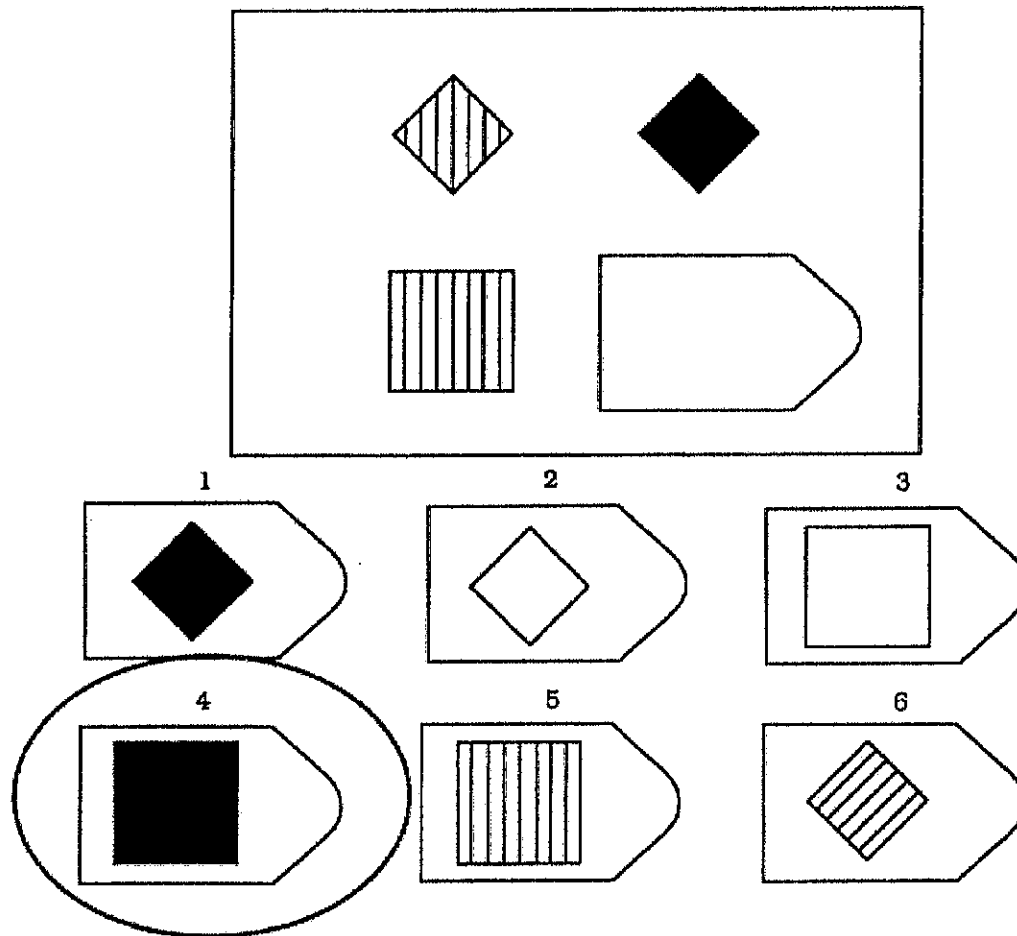


# Analogical Assessment

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In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

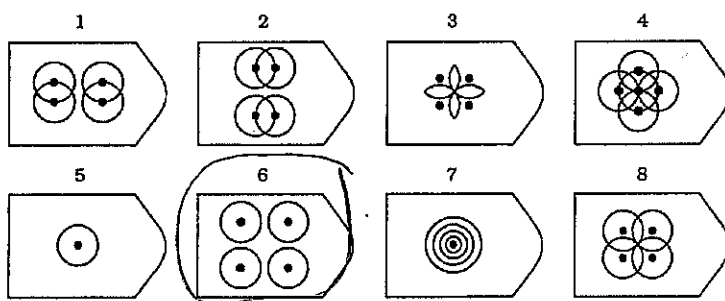
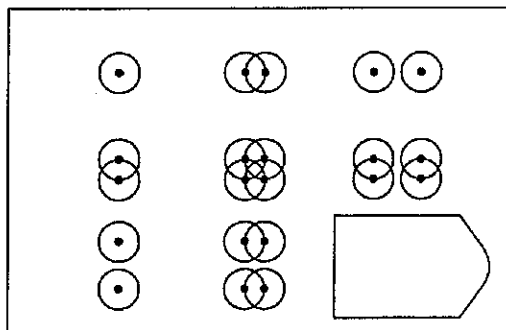


**Answer: 4**

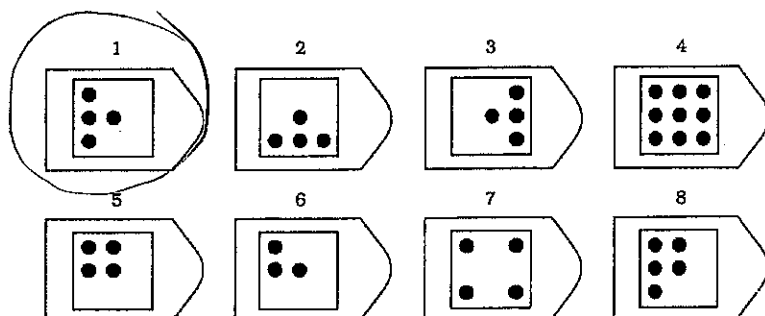
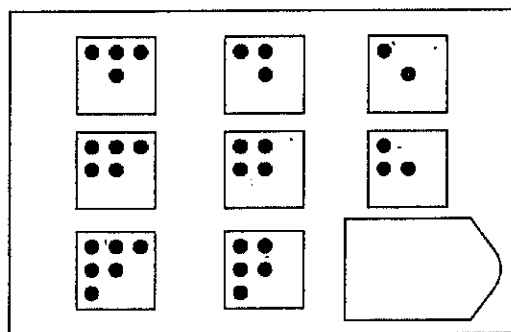
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

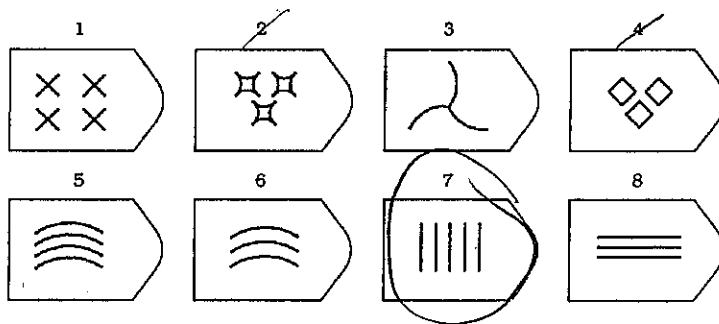
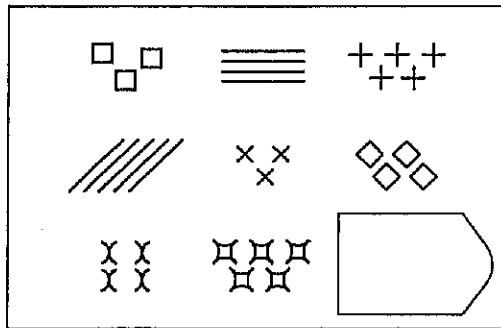


### PATTERN 2

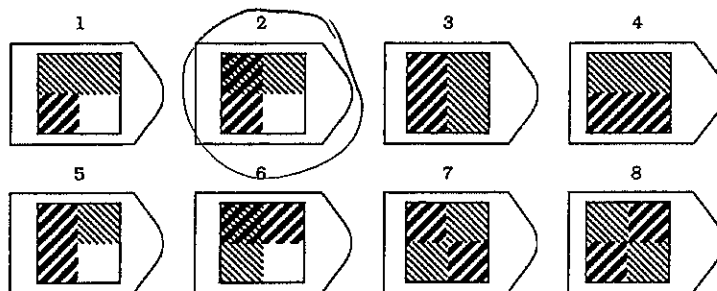
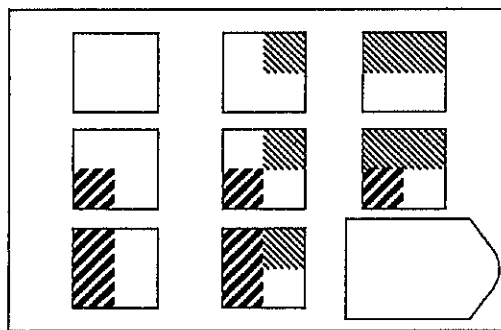


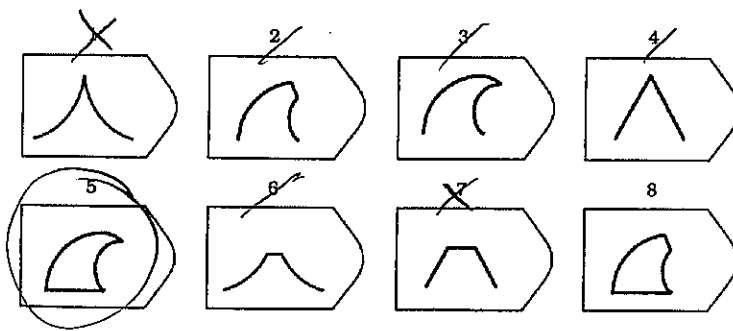
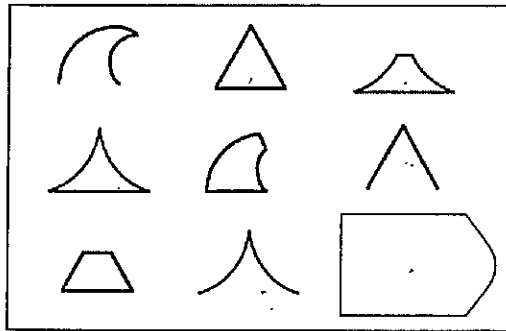


## PATTERN 3



## PATTERN 4



**PATTERN 5**

5

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- B
- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
  - ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
  - C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
  - D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- A
- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
  - ~~B.~~ Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
  - ~~C.~~ Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
  - ~~D.~~ Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- D
- ~~A.~~ Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
  - B. Bob was able to maximize his work time by cutting back on watching TV during the day.
  - ~~C.~~ Sean has been closely monitoring his eating in an attempt to improve his diet.
  - ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- C
- A. After eating a big lunch, Dan went back to his office and took a nap.
  - B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
  - ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
  - D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

~~A.~~ Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.

B ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.

~~C.~~ Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.

~~D.~~ On the basis of new information, the police officer revisited the crime scene to look for new evidence.

---

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

A. Getting high. They are both involve too much of a chemical influencing the body.

B. Hitting your head. They both involve something that causes headaches.

D ~~C.~~ Being sleep deprived. They both involve impaired functions.

☒ D. Eating too much candy. They both involve lack of self-control.

E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

☒ A. Dew forming. They are similar because they both involve a drop in temperature.

B. Blowing up a balloon. They are similar because they both involve becoming less dense.

A ~~C.~~ Clouds forming. They are similar because they both involve a phase change.

D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 60453

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: [REDACTED]  
Version B

GROUP: A40575915

C2

25

MULTIPLE-CHOICE. 5 points each (50 points total).

- A 1. Which of the following would be considered a negative feedback to increasing global temperature?
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- B
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A = erosion, B = deposition, C = uplift and erosion
  - b. A = erosion, B = biochemical precipitation, C = uplift and deposition

C

  - ☒ c. A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - d. A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- A
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- B
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- C
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B ☒ a. The reservoir will eventually disappear.  
☐ b. The reservoir is not in equilibrium.  
☐ c. The reservoir is growing smaller.  
d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A ☒ a. The Earth's atmosphere would become colder than it is today.  
☐ b. The Earth's atmosphere would become warmer than it is today.  
c. The Earth's atmosphere would remain about the same temperature as it is today.  
d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☐ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase  
c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
D ☒ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
☐ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
D ☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ø

An increase in atmospheric Carbon dioxide would raise the temperature in the atmosphere therefore causing the ocean to heat up. The heat from the atmosphere would raise the pH levels and acidity of the ocean. As the temperature increases in the atmosphere and in the water the pH levels also increase. This acidification could ruin the habitat for many living creatures and plants in the ocean if the pH levels rise too high. The pH levels could also affect the lithosphere and atmosphere in a negative way. Their ability to clean this water for drinking could also be a problem if pH levels rose extremely high in the water. However if the ocean were cooler it would absorb sun more and heat up that way too like the example in class with volcanic ash and the ocean. The heated ocean could cause glaciers to melt quicker giving more...

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

5  
The greenhouse effect says that if the Earth were to have volcanism suddenly increase dramatically with large ash clouds, the earth would be taking in more infrared energy than energy from direct sun rays. The Earth's crust is less dense than the lithosphere which allows for volcanoes to erupt as the layers melt and rise to the surface. The ashes and ash clouds would take away a lot of sunlight that would help photosynthesis and many plants and trees would die because of this. With less plants and trees the deforestation would cause there to be less oxygen on earth and there would be more  $\text{CO}_2$  trapped on earth, causing the atmospheric temp. to rise. With a lack of plants, trees, and oxygen this would clearly be a catastrophe for living things.

no g. en  
exph  
or - use

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Both cause air energy to rise into the atmosphere. Evaporation causes clouds.



## Angel Note:

I sent an email probably a week ago that my homework (longer assignments) online and my exam 2 grade were not showing up on Angel. The only thing showing up are the short HW assignments. (Did not take exam 1 due to hand injury still have Dr. Note if needed again).

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

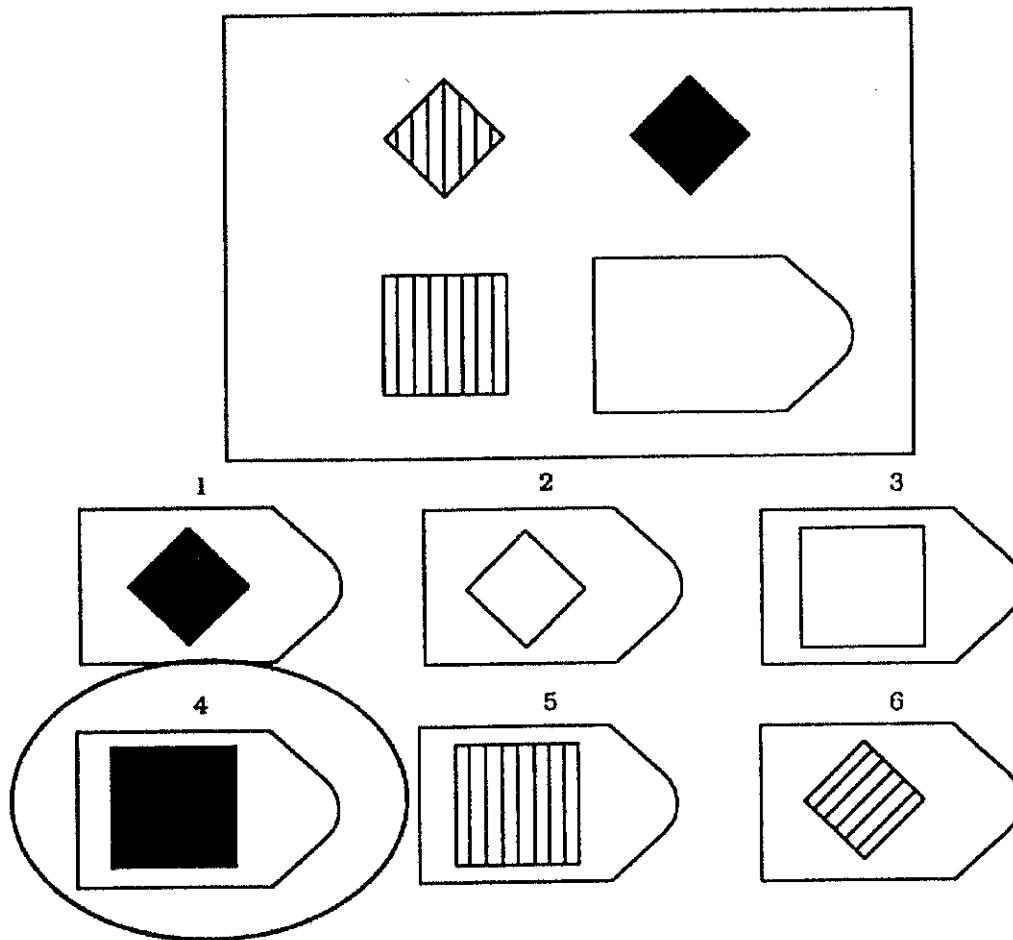
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

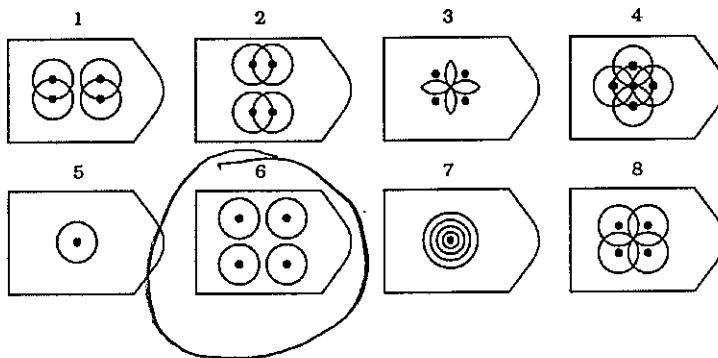
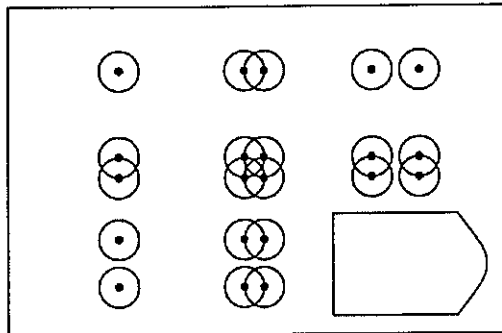


**Answer: 4**

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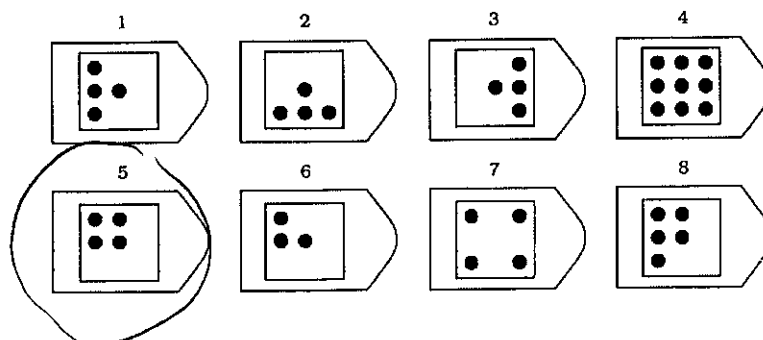
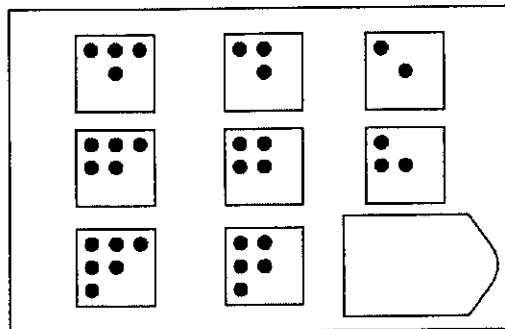
Please choose the image that best completes each of the following patterns.

### PATTERN 1



6

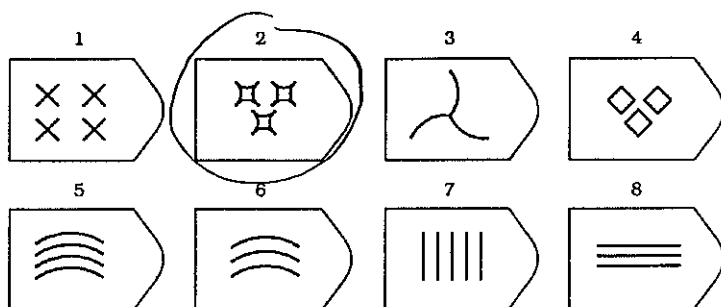
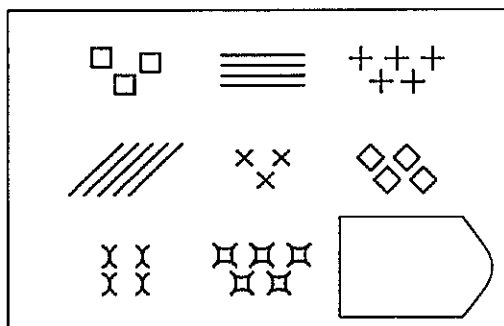
### PATTERN 2



5

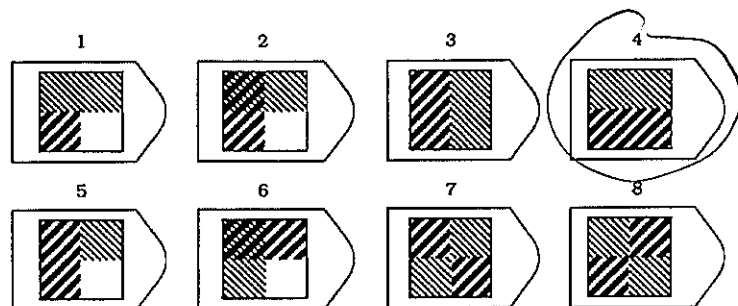
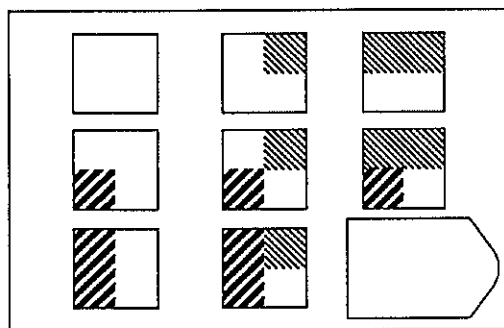
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## PATTERN 3

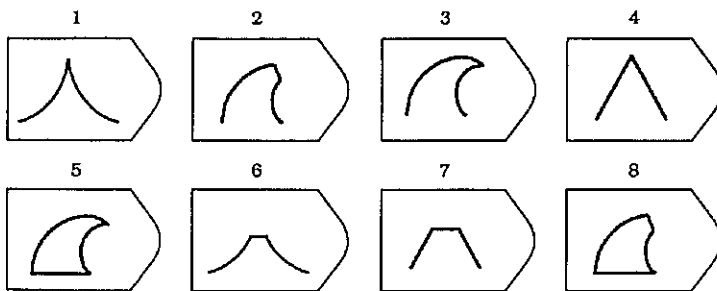
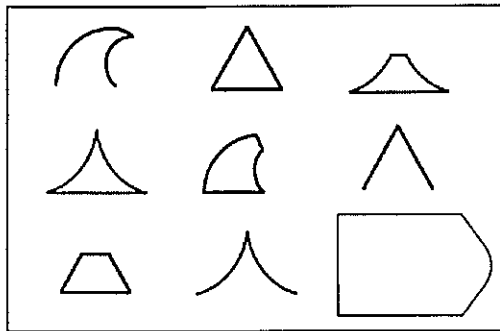


2

## PATTERN 4



4

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

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PLEASE CONTINUE ON NEXT PAGE

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4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

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PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

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Please choose the response that is closest to an analogy that you might make.

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C. Being sleep deprived. They both involve impaired functions.

D. Eating too much candy. They both involve lack of self-control.

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☒ A. Dew forming. They are similar because they both involve a drop in temperature.

B. Blowing up a balloon. They are similar because they both involve becoming less dense.

C. Clouds forming. They are similar because they both involve a phase change.

D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48070

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other



STUDENT NAME: A 38181168  
Version A

GROUP: C2

31

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- ☒ D
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- ☒ C
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- ☒ A
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
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  - d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- ☒ C
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
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5. Which of the following would cause the acidity of Earth's oceans to decrease?

- ☒ A
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
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6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- ☒ B
- a. Reservoir A has a shorter residence time than Reservoir B.
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8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ B
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☒ B
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**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

~~Am~~ Ocean acidification involves carbon dioxide in the ocean with too much carbon dioxide the ocean becomes more acidic. If the atmospheric carbon dioxide increases then it will ~~eventually~~ eventually precipitate? into the ocean creating a more acidic ocean. It will absorb the carbon dioxide from the atmosphere and it will eventually dissolve into the water. This could be positive because the water could be hotter but, it could be negative as well due to it being too acidic it may kill off the fish and contaminate the water.

5

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

2 The volcanoes with the large ash clouds ~~is~~ would gradually get absorbed in the atmosphere causing the Earth's atmospheric temperature to go up. Many times during greenhouse effect gases are absorbed and reflected causing the temperature to be balanced in a proper way. The greenhouse effect is what assists the temperature in being cold at night and hot during the day. These temperatures are regulated by the greenhouse effect so it is not too cold at night and not too hot during the day. If the volcanism increasing and creates more gases than before it will cause some of the gas to be left over which would increase the atmospheric temperature.

1

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are similar because the both involved the formation of a gas.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

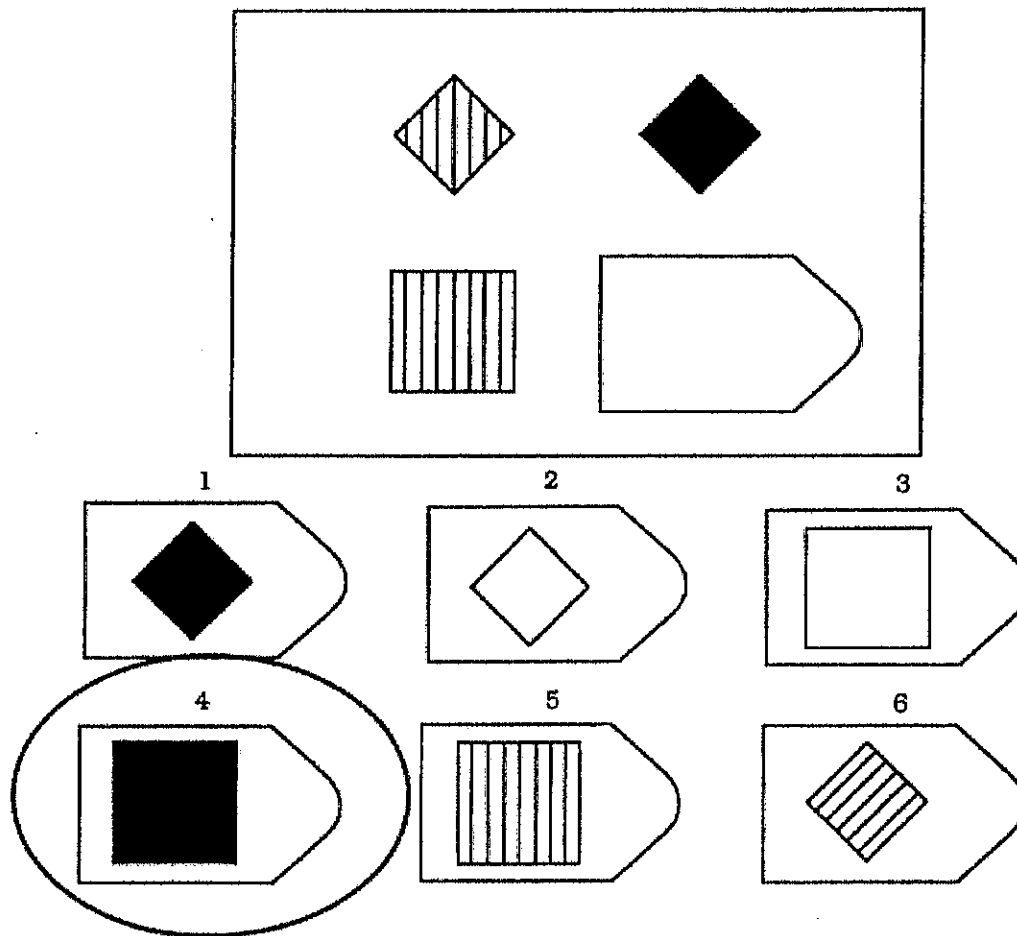
**Thoughtfully complete the attached survey**



# Analogical Assessment

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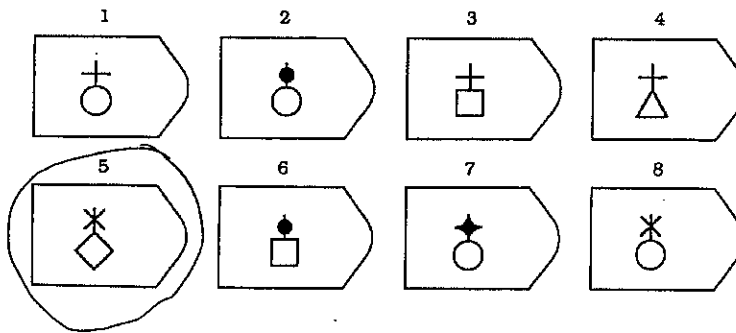
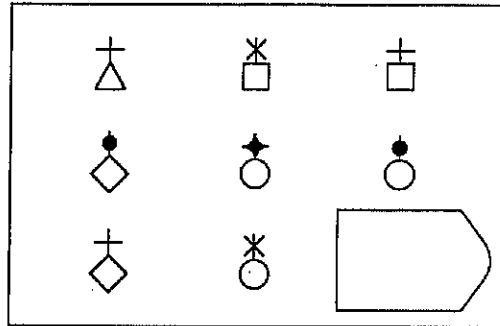


**Answer: 4**

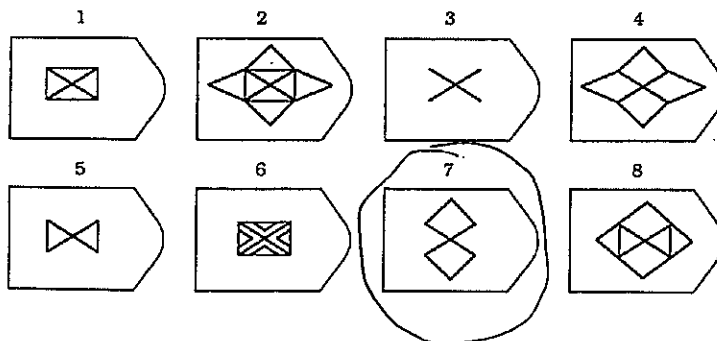
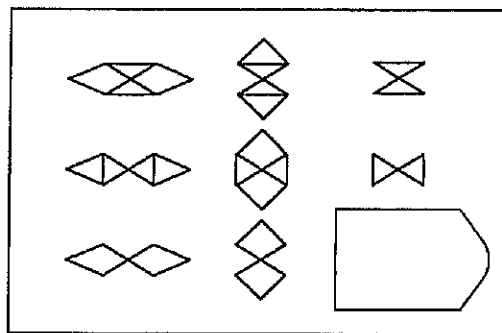
PLEASE CONTINUE ON NEXT PAGE

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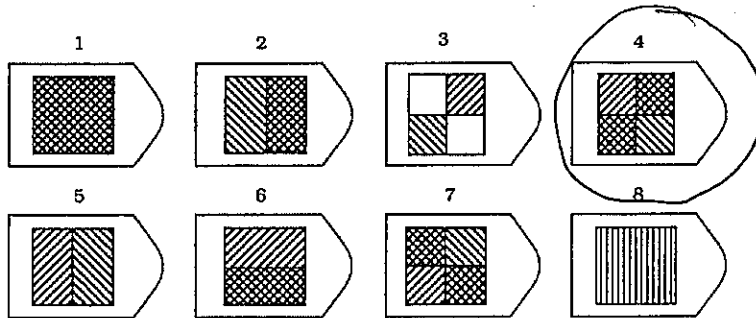
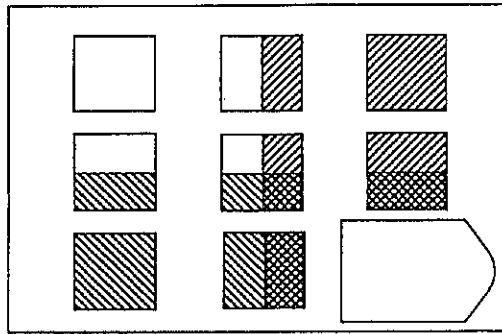
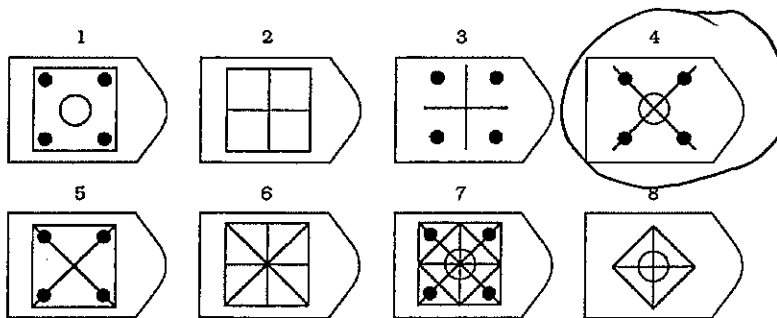
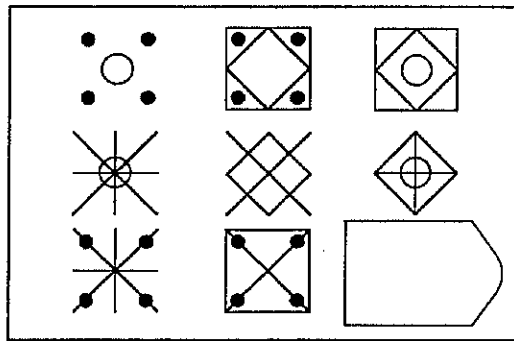


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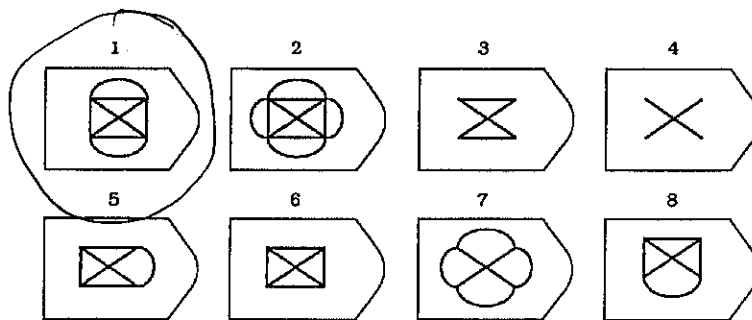
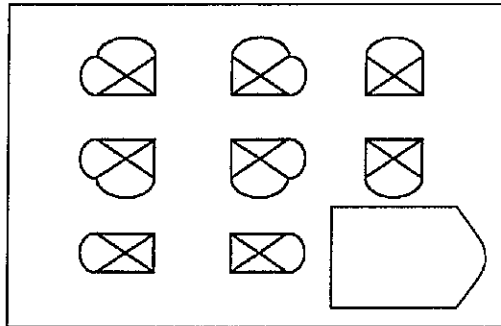


PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

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In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

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PLEASE CONTINUE ON NEXT PAGE

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- ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 22 years

What is your home zip code? 48910

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☒ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A40741960  
Version A

GROUP C2

50

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
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4. Which of the following statements about the greenhouse effect on Earth is most accurate?
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5. Which of the following would cause the acidity of Earth's oceans to decrease?
  - ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
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  - a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - ☒ c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
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  - ☒ c. The reservoir is growing smaller. C
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- ~~a. Reflection of more solar radiation, causing atmospheric temperature to decrease~~
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- a. The Earth's atmosphere would become colder than it is today.
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  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same. D

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

- \* Ocean acidification is the process by which carbon dioxide molecules are distributed and degassed from the ocean. If  $\text{CO}_2$  in the atmosphere increased then there would also lead to higher levels of  $\text{CO}_2$  in the oceans. This is primarily because this process has a desire to reach equilibrium.
- If there is a significant amount of  $\text{CO}_2$  in the atmosphere then in order for this system to return to equilibrium  $\text{CO}_2$  molecules would go into the ocean. This would cause the oceans to become more acidic. The increased ocean acidity could then bring about problems for aquatic life in the oceans.
- If the amount of  $\text{CO}_2$  in the ocean is greater (relatively) to the amount of  $\text{CO}_2$  in the atmosphere than the  $\text{CO}_2$  through degassing will go from the ocean to the atmosphere causing the system to reach equilibrium once again, and decreasing the overall acidity levels of the ocean.

20

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

How? An increase in volcanism would bring about more ash. This ash would affect the amount of sunlight that can be absorbed and reflected on earth. If more ash is in the atmosphere then less visible light will be able to reach the earth. The light that does reach the earth and isn't reflected back into outer space will be the cause of BOTH the greenhouse effect and volcanism's effects on the greenhouse. Volcanism here on earth would lead to higher CO<sub>2</sub> levels being emitted into the atmosphere.

The greenhouse effect consists of 3 main gases: Carbon Dioxide, methane, and water vapor, that are in the atmosphere that traps IR waves reflected from earth. Through volcanism's increase in CO<sub>2</sub> the greenhouse will trap even more IR causing the earth to warm.

15

X Extra credit (2 points).

How are evaporation and degassing similar and/or different?

- Evaporation is the process of a liquid turning into a gas entering the atmosphere.
- Degassing is the process by which carbon is moved from the oceans to the atmosphere.
- Both are taking atoms and molecules from the earth's surface & bringing them to the atmosphere.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

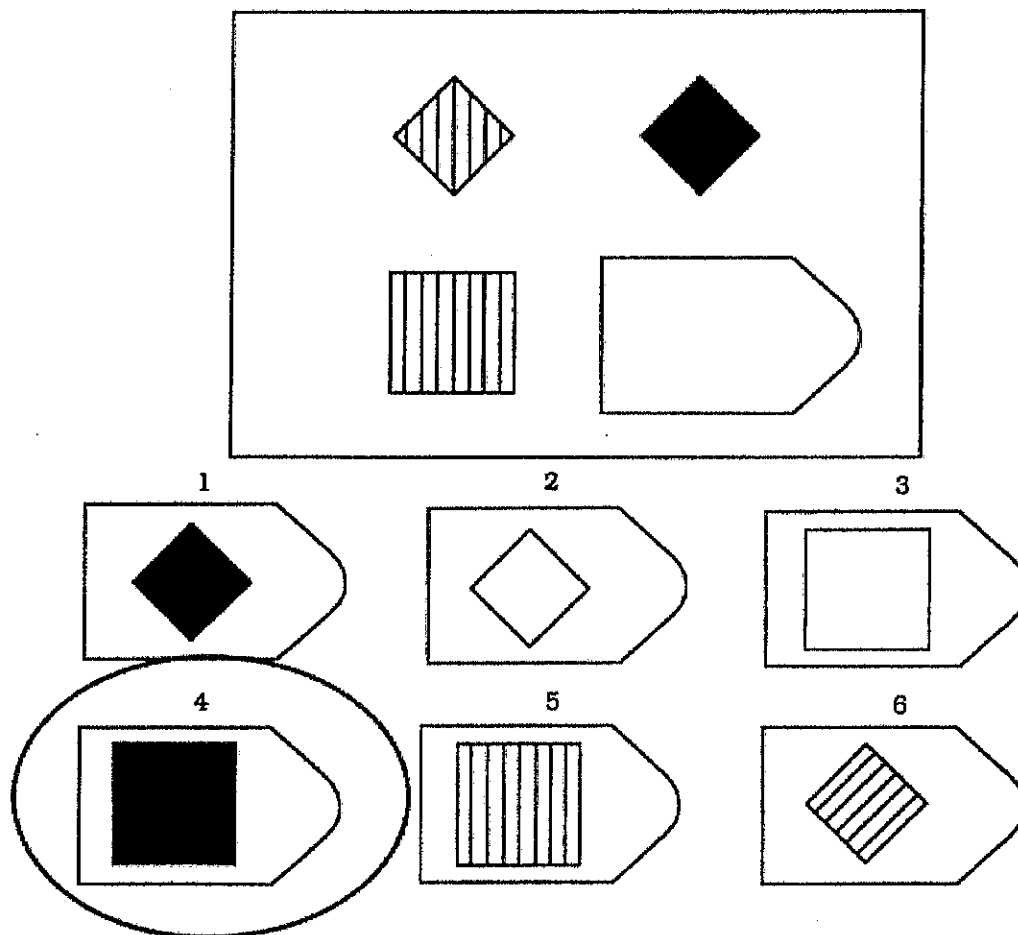
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# Analogical Assessment

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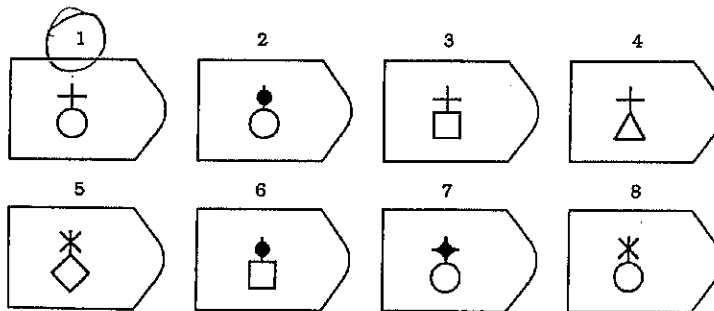
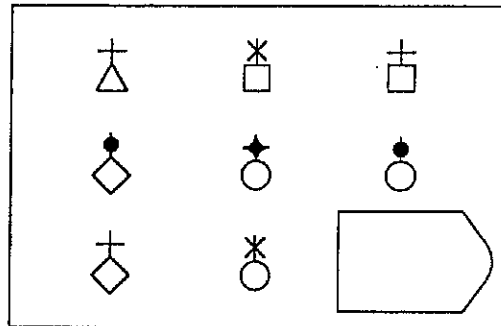


**Answer: 4**

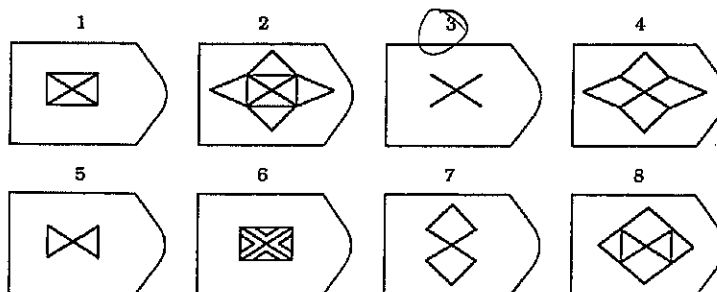
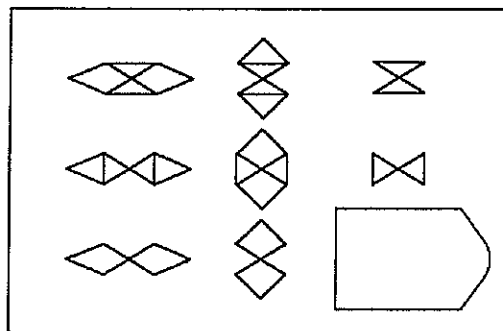
PLEASE CONTINUE ON NEXT PAGE

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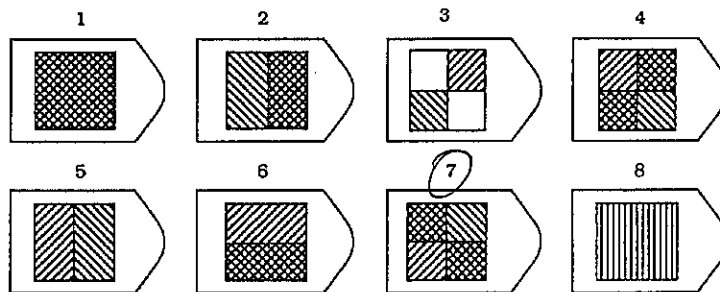
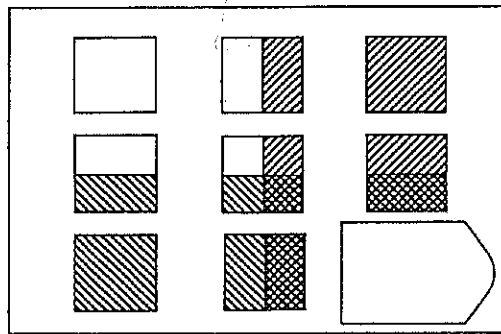


### PATTERN 2

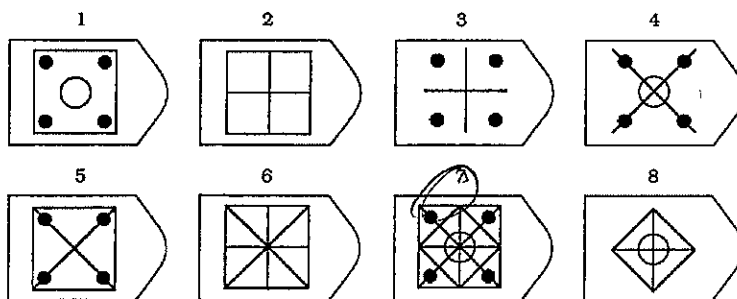
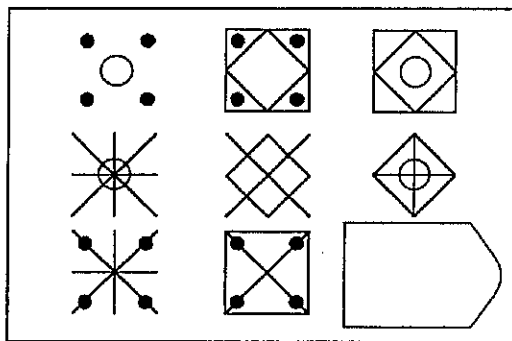


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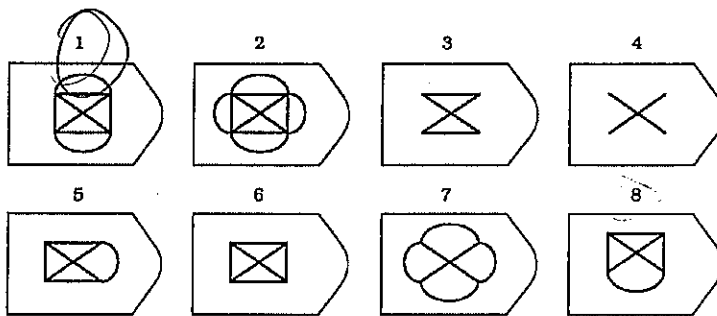
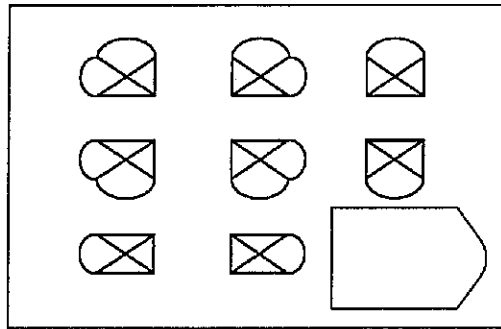
## PATTERN 3



## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

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#### DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 40322

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☒ African American/Black  
☐ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other



STUDENT NAME: A43481863  
Version A

GROUP C2

77

**MULTIPLE-CHOICE. 5 points each (50 points total).**

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**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

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✓

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

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- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

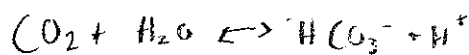
-  $\text{CO}_2$  in the atmosphere dissolves into the ocean where it reacts with the water to become hydrogen and an acid.

- As  $\text{CO}_2$  in the atmosphere increases, it should mean an increase in ocean acidification, however - at same point, due to the greenhouse effect, the  $\text{CO}_2$  in the atmosphere will cause global warming. If the oceans are warmer, their ability to dissolve gases like  $\text{CO}_2$  is diminished, = a negative feedback loop

- A positive feedback loop to ocean acidification would be when it gets too acidic, it will kill plant life in the ocean that absorbs  $\text{CO}_2$ , this will cause an even greater abundance of  $\text{CO}_2$  and will cause even more ocean acidification

 $\text{CO}_2$  in Atmosphere

Dissolution



↑  
acid

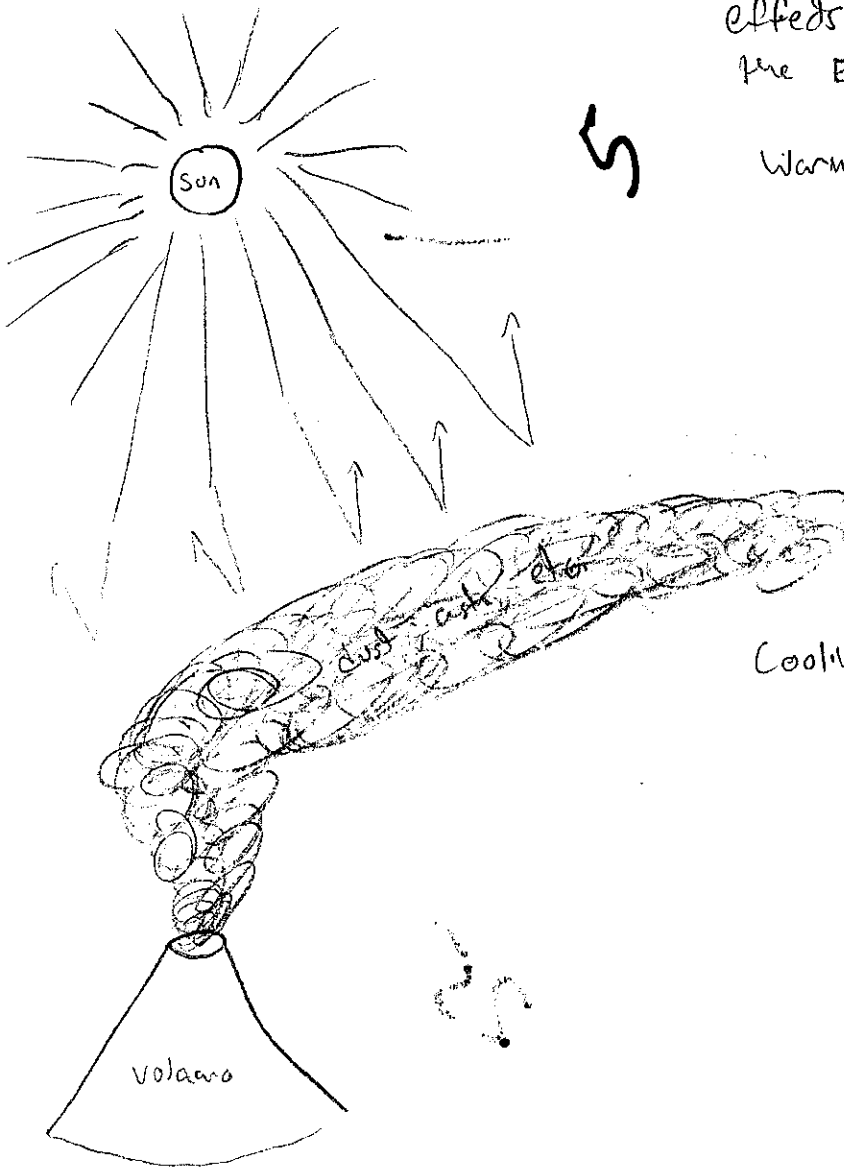
25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Increased volcanism on Earth would have effects that would both warm and cool the Earth.



Warming: the volcano would release greenhouse gases. These gases would capture and re-emit energy from the sun, making it more difficult to reflect the energy back to space. This would cause an increase of the energy and therefore temperature on Earth.

Cooling: the dust, ash, etc. that is released by the volcano will serve to reflect the solar radiation back into space, causing less energy to reach Earth, i.e. cooling.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Both involve atoms/molecules of gas being freed from a liquid, but in evaporation: the atoms/molecules were once a part of the liquid that had been freed, in degassing, the gas atoms/molecules were always a gas, it had not been dissolved in the liquid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

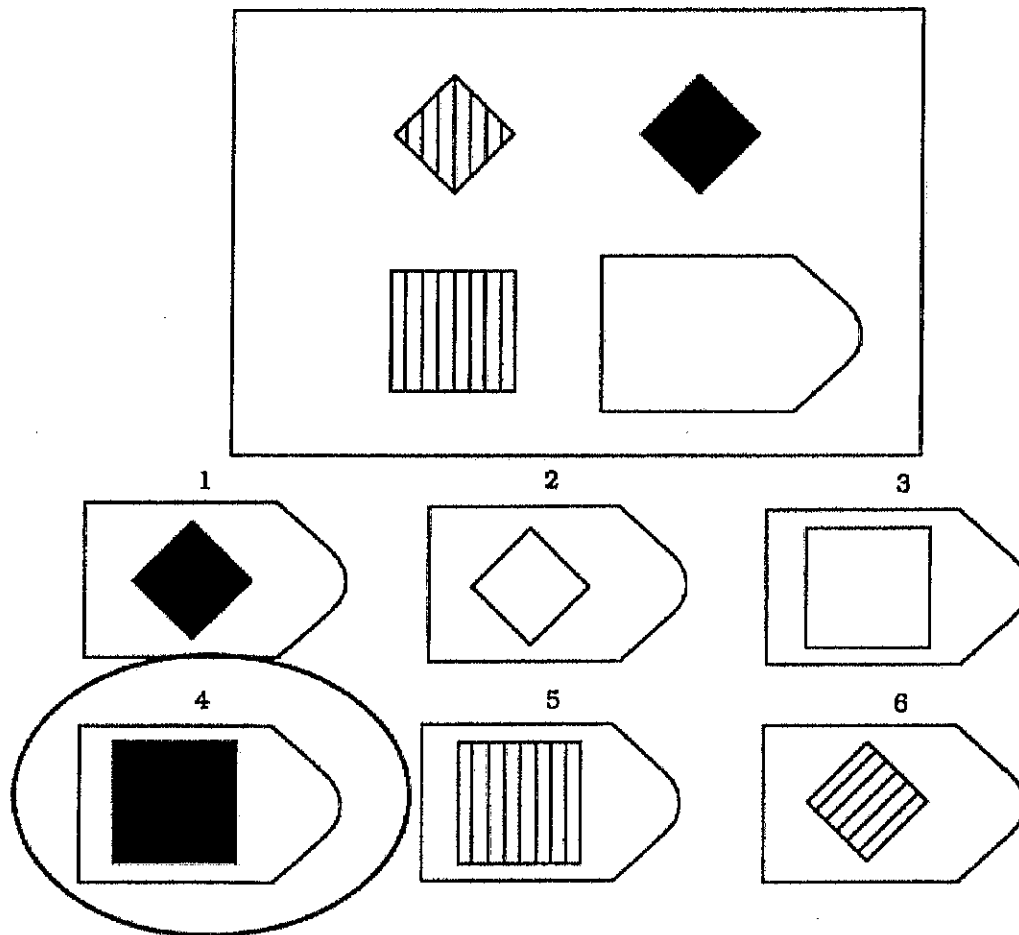
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

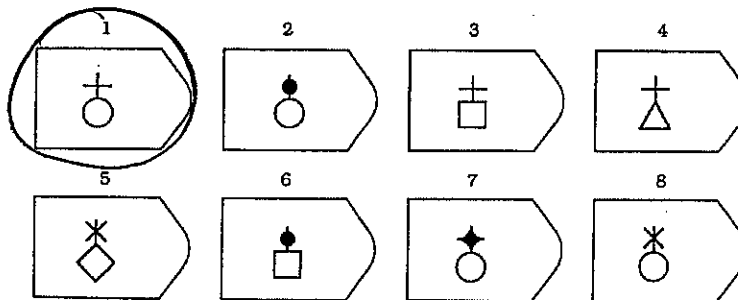
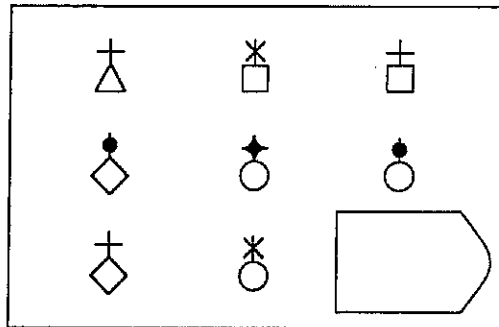


**Answer: 4**

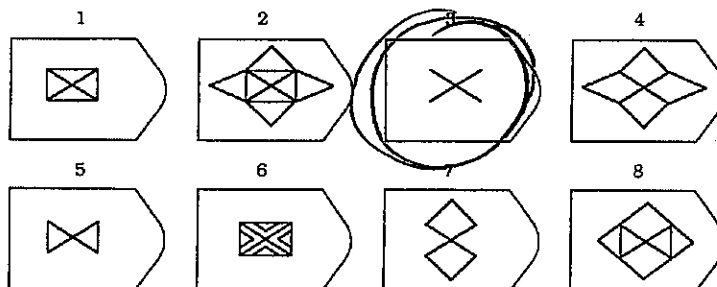
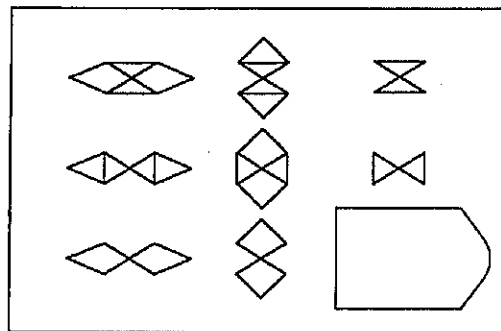
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

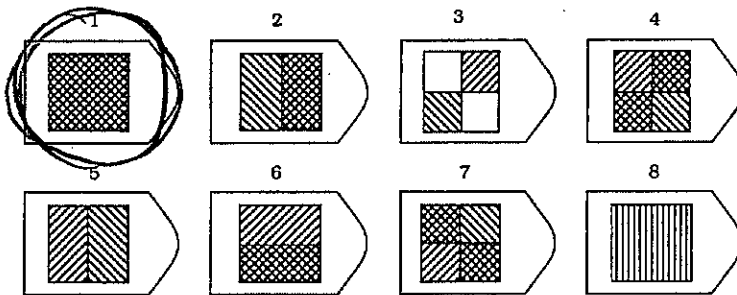
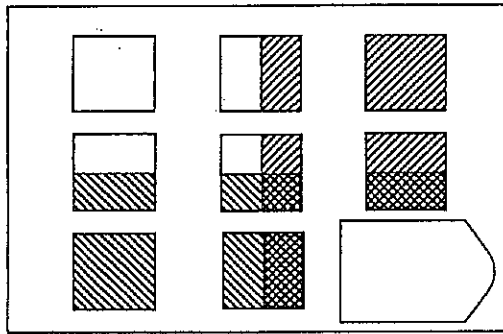


### PATTERN 2

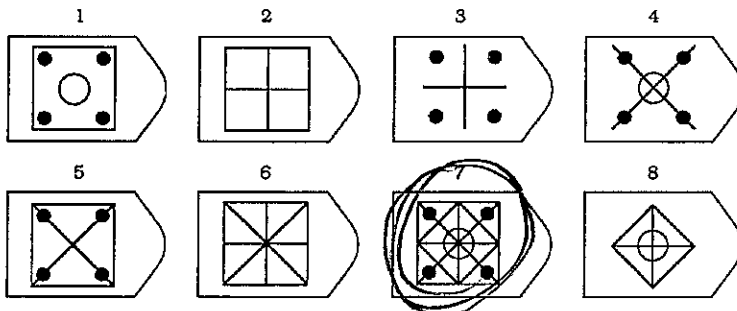
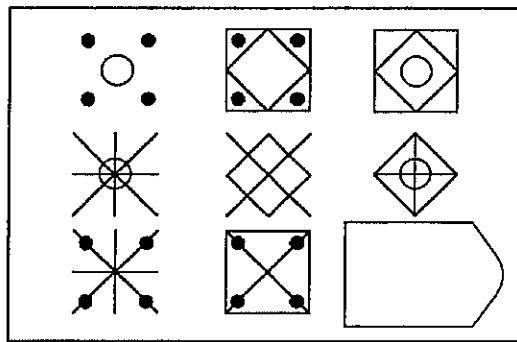


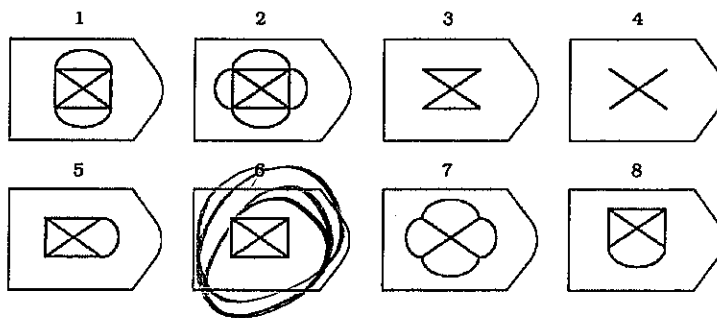
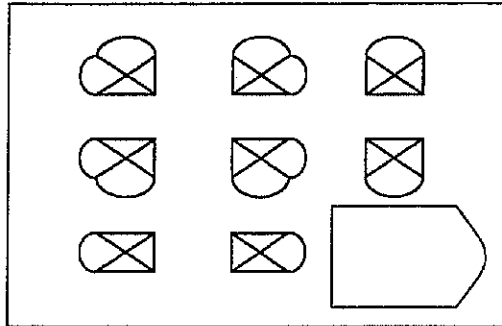


**PATTERN 3**



**PATTERN 4**



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

C ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

D ☐ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

A ☐ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

C ☐ B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - D C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- A A An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- D C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48089

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A42087601  
Version A

GROUP: C2

37

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- B 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
- C 2. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ An increase in evaporation and cloud formation resulting in the release of latent heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
- C 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion
  - A = erosion, B = biochemical precipitation, C = uplift and deposition
  - ☒ A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - A = dissolution, B = deposition, C = uplift and deposition
- B 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - ☒ Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
- C 5. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- B 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- A 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- C 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation, and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- C 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - ☒ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

a. Ocean acidification results from the amount of carbon dioxide it absorbs. Energy is released from the sun and can be absorbed/re-emitted or reflected. The energy ~~and~~ absorbed into the ocean becoming a bicarbonate ( $\text{HCO}_3^-$ ) and hydrogen ion, releasing acidifying carbon into the ocean.

b) More  $\text{CO}_2$  in the atmosphere would create a higher ocean acidification. (lower pH) This would lead to an increase in temperature and less evaporation. There would be less <sup>(negative feedback)</sup> cloud coverage so more energy could be absorbed by the ocean. This would be a positive feedback loop of increasing temperature.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

b. volcanic ash would block absorption of energy by the earth resulting in a decrease of temperature. The earth would be unable to absorb the infrared energy from the sun through the ashes. This reduction in temperature would lead to more cloud cover, due to increased evaporation, and would further the temperature decline.

A. The greenhouse effect is when the earth is absorbing the <sup>long wavelength</sup> infrared energy, heat, from the sun. The energy is reemitted and can be caught by greenhouse gases. These gases then reemit the energy in every direction and so it is reemitted in the atmosphere. The heat energy gets "trapped" in the atmosphere causing rising temperatures.

5

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are both effects. Evaporation leads to clouds with water and degassing releases CO<sub>2</sub> before eruption.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

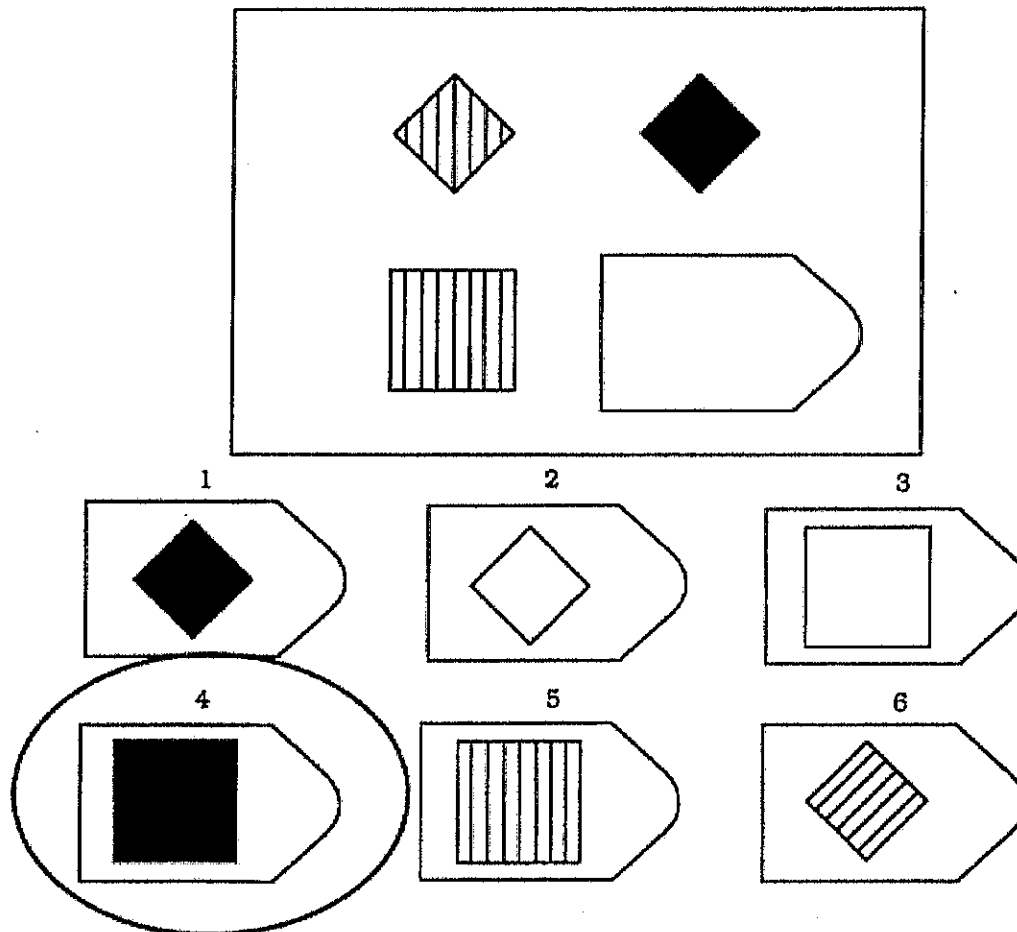
**Thoughtfully complete the attached survey**



# Analogical Assessment

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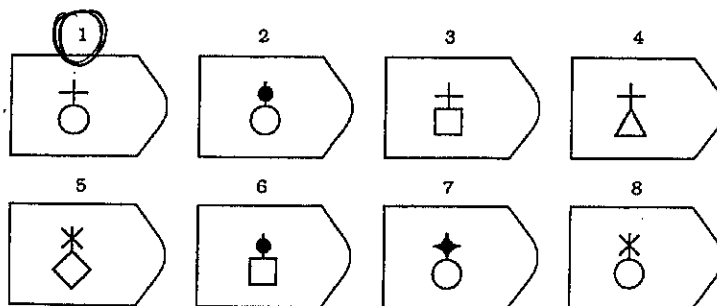
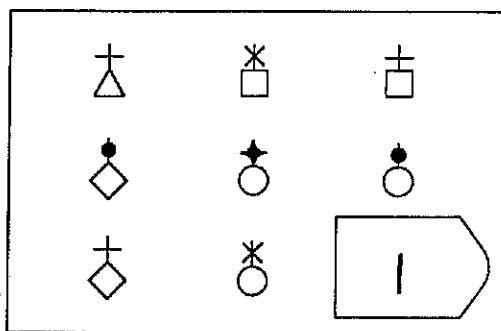


**Answer: 4**

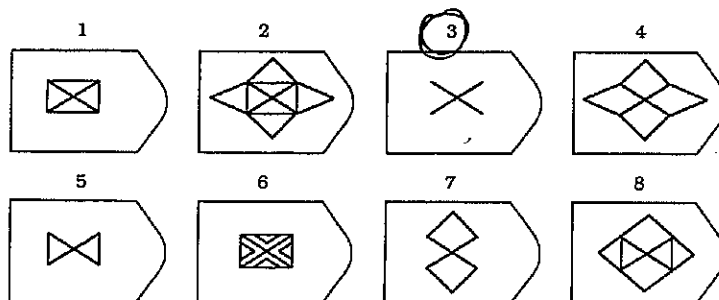
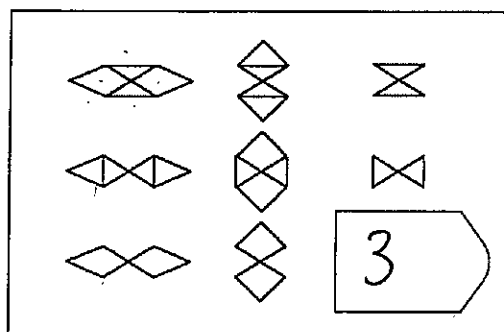
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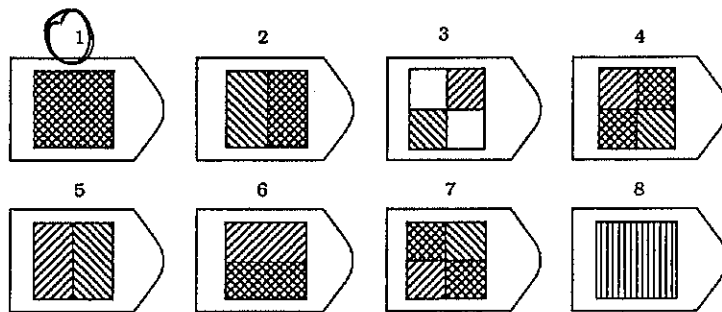
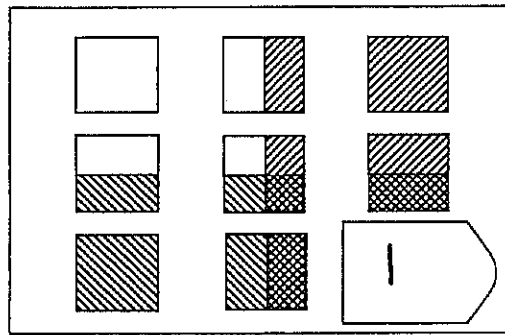
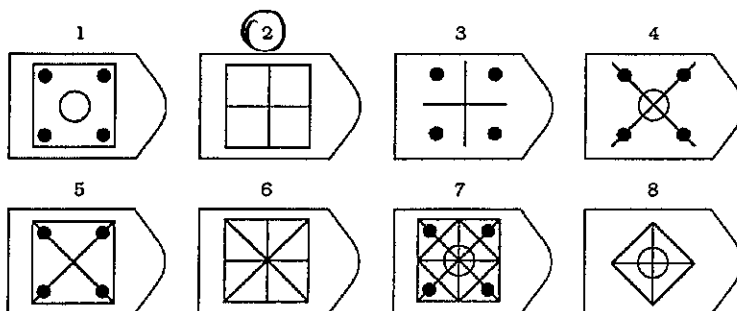
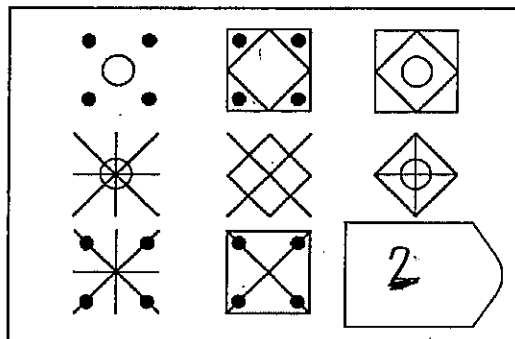
### PATTERN 1



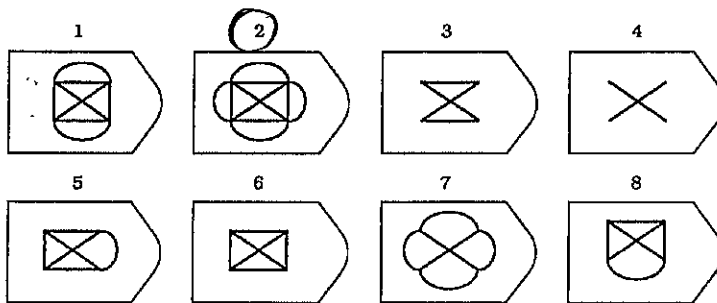
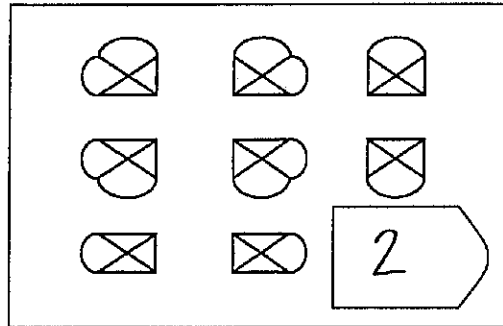
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

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PLEASE CONTINUE ON NEXT PAGE

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  - ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
  - C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
  
2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.
  - A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
  - B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
  - C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
  - ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.
  
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  - ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
  - B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
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4. The rival gangs used graffiti to define their territorial boundaries.
  - A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
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*PLEASE CONTINUE ON NEXT PAGE*

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
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- 

Please choose the response that is closest to an analogy that you might make.

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- A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
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2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 98187

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other



STUDENT NAME: A42818831  
Version A

GROUP: C3

55

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- ✓ 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- ✗ 2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A= erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A= dissolution, B= deposition, C= uplift and deposition
- ✗ 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- ✗ 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - ☒ d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- ☒ 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

20

A. Ocean acidification occurs when  $\text{CO}_2$  is dissolved into the ocean from the atmosphere.  $\text{CO}_2$  reacts with the  $\text{H}_2\text{O}$  already present in the ocean to produce hydrogen carbonate, a negatively-charged ion, and a hydrogen atom, a positively-charged ion. The increase of  $\text{H}^+$  in a solution increases that solution's acidity. ✓

B. When more  $\text{CO}_2$  enters the ocean from the atmosphere, the ocean becomes more acidic. However, hydrogen can also leave the ocean via plant-respiration-produced oxygen bonding - water is formed, which then evaporates. So, the only way acidity increases beyond equilibrium is if  $\text{CO}_2$  does as well.  $\text{CO}_2$  is a greenhouse gas, so it has a positive feedback effect on the Earth's temperature.  $\text{CO}_2$  traps heat, which causes evaporation which eventually

? leads to the release of more  $\text{CO}_2$ . Due to high  $\text{CO}_2$  emission rates, oceans also experience higher levels of  $\text{CO}_2$ , and therefore, acidity levels. So, when  $\text{CO}_2$  enters the ocean, water becomes more acidic.  $\text{CO}_2$  in the atmosphere builds up, while  $\text{CO}_2$  continues to flow and acidity levels increase; this is a positive feedback loop. However, generally, higher temperatures means more evaporation. With high  $\text{CO}_2$  levels causing higher temperatures, evaporation becomes less of a factor and sea levels increase as glaciers melt. Acidity increases leading to the recycling of  $\text{CO}_2$  causing higher temperatures and higher sea levels is a negative feedback loop.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

5

A. Volcanoes form at plate boundaries where magma forms at high temperatures and the plate isn't thick enough to keep the magma down. The magma bubbles towards the surface, eventually erupting in a Spew of ash and lava. The atmosphere in the aftermath of a volcanic eruption experiences much higher temperatures. The ash cloud blocks and traps much of the [sun's reflected/re-emitted radiation; this is known as the greenhouse effect]. The greenhouse effect leads to an increase in atmospheric/global temperature. Subduction is the process by which magma is initially allowed to form, so it is perhaps the catalyst for volcanic eruptions. Subduction occurs when plates of relatively less density slip under plates of higher density. This massive amount of energy generated by subduction translates to intense thermal increases in a subduction zone. The increased temperature in these zones, combined with the water let through the rock by subduction, causes rocks to melt and, subsequently, magma to form. Another significant result of eruptions is the positive feedback loop that generates as a result of the greenhouse effect. The gases in the atmosphere trap heat, that heat leads to more gas in the atmosphere, and so forth.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is the escape of H<sub>2</sub>O from water into the atmosphere because of temperature. Degassing is the release of gases from metamorphic rocks into the atmosphere. The while degassing is gravitational, is chemical.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

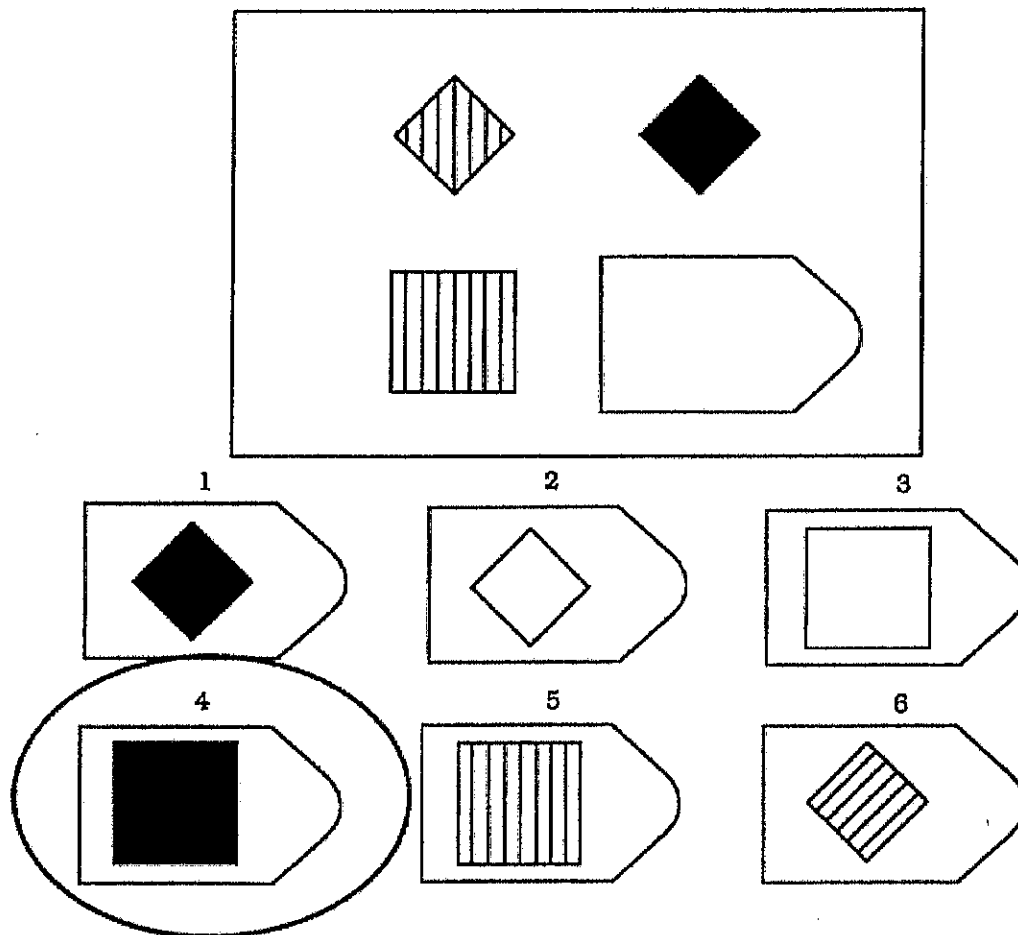
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

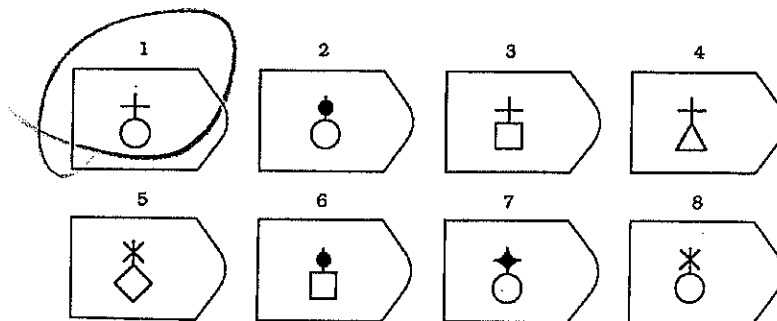
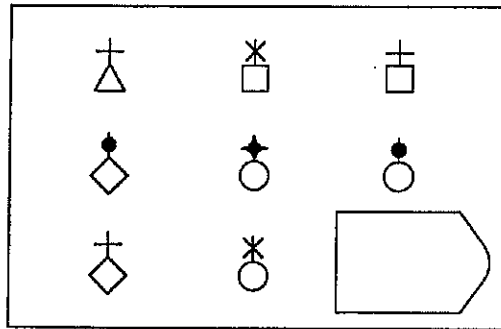


**Answer: 4**

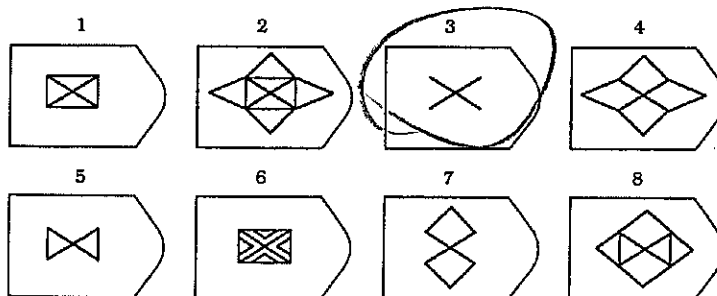
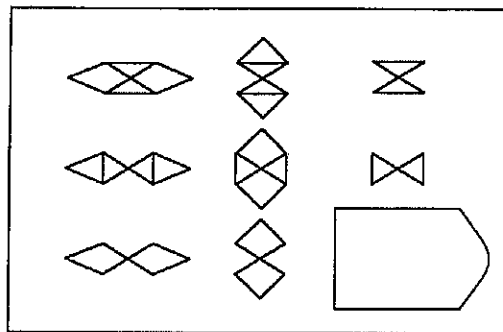
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

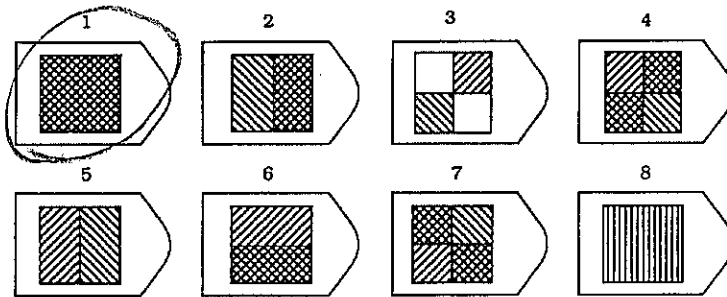
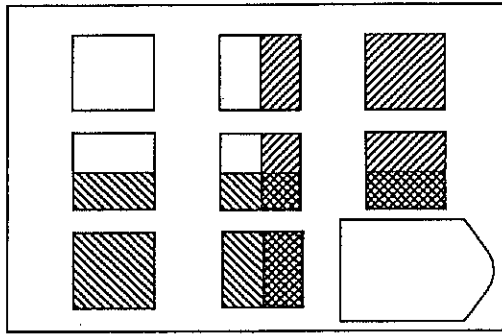
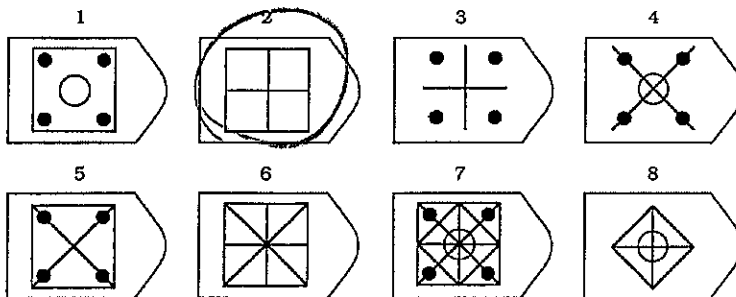
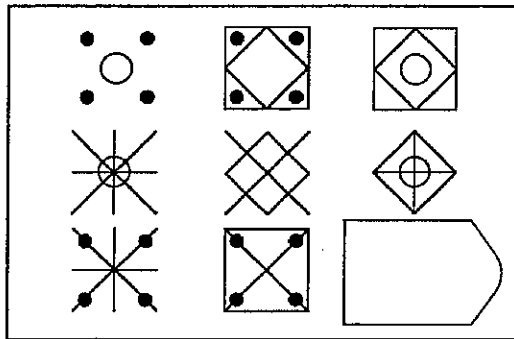


### PATTERN 2

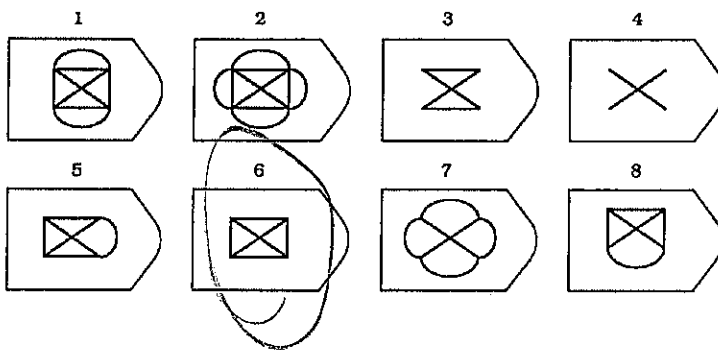
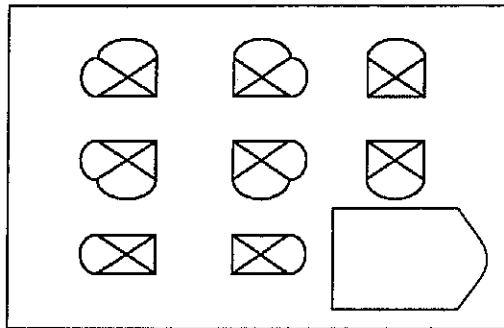


PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48375

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A 43206773  
Version B

GROUP C3

72

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

a. Ocean acidification is a term that refers to how acidic the oceans are. Acidity is the concentration of hydrogen ions in water. The more hydrogen ions that are in water, the more acidic the water becomes. When carbon dioxide interacts with water, bicarbonate ions and hydrogen ions are formed. When temperature increases, the process of carbon dioxide entering the oceans slows down. This makes the water less acidic. However, when the concentration of carbon dioxide increases in the atmosphere, this would result in more carbon dioxide in the oceans. This increase in carbon dioxide in the oceans would form more hydrogen ions, thus making the water more acidic. Therefore, an increase in atmospheric carbon dioxide would cause ocean acidification to increase as well.

b. Negative Feedback Loop: When temperature increases, the process of carbon dioxide entering the oceans slows down. This makes water less acidic.

Positive Feedback Loop: When the concentration of carbon dioxide in the atmosphere increases, this would result in more carbon dioxide in the oceans. This makes the water more acidic.

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

An increase in volcanism would cause Earth's atmospheric temperature to go down. According to the greenhouse effect, clouds reflect incoming solar radiation. This radiation then goes back into space without heating the earth's atmosphere, causing global temperature to decrease. If there was a dramatic increase in volcanism where large ash clouds are produced, these ash clouds would reflect incoming solar radiation where it would then be sent back into space. Since this solar radiation would fail to reach the earth's atmosphere, infrared radiation would not be able to be absorbed as heat. This would therefore lower Earth's atmospheric temperature.

10

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are different. Evaporation refers to the state of liquid water being changed into water in the gaseous state. Degassing refers to gas within a liquid leaving the liquid and being released into the atmosphere.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

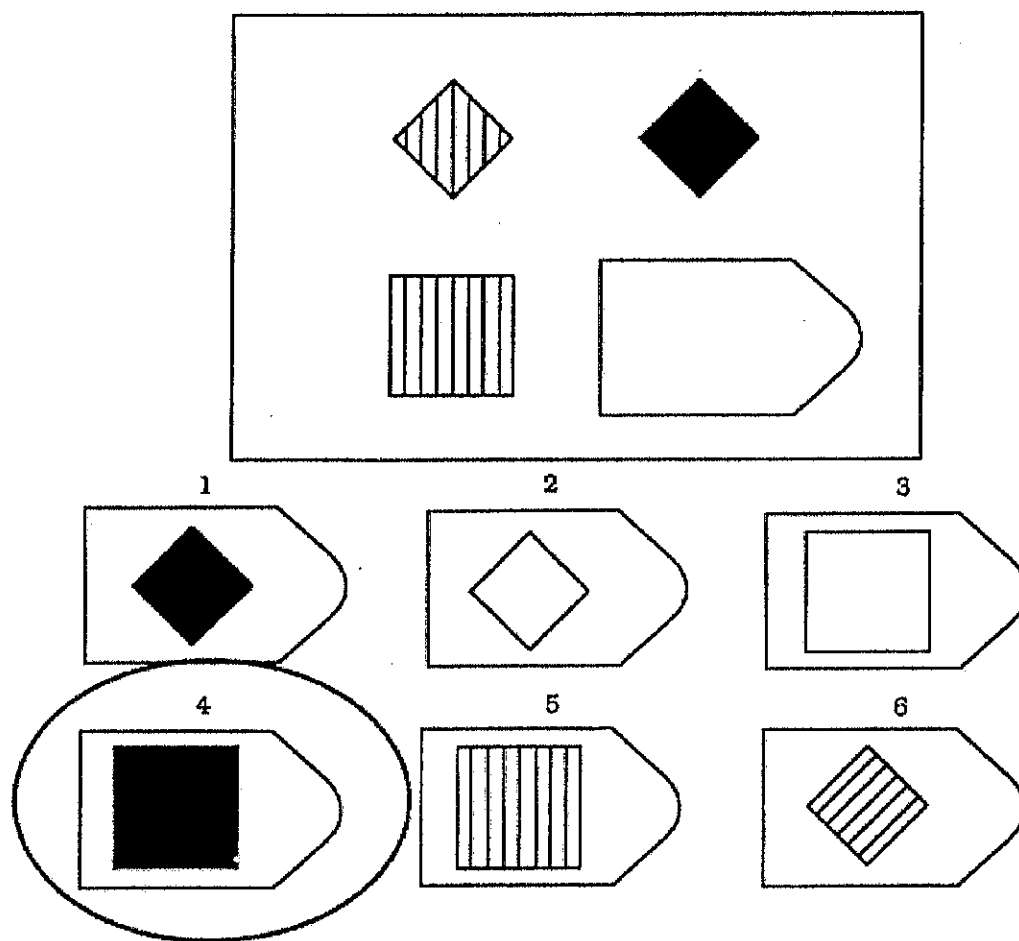
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

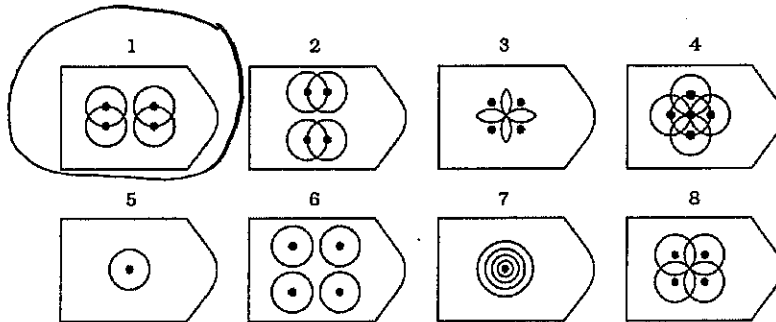
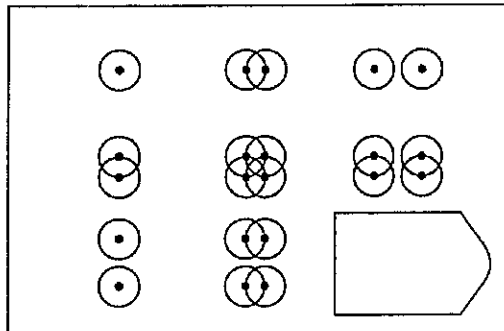


**Answer: 4**

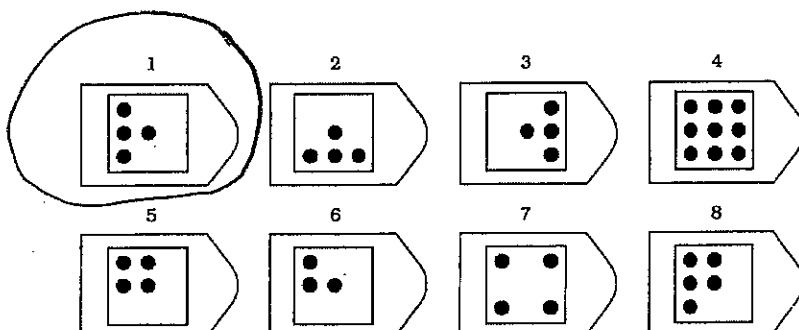
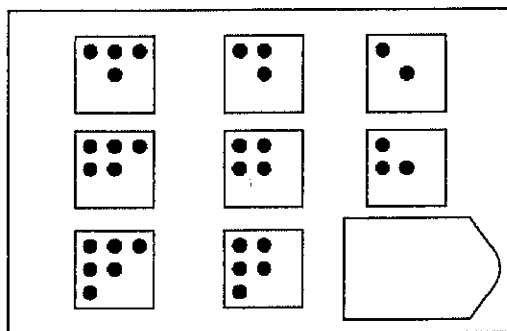
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Please choose the image that best completes each of the following patterns.

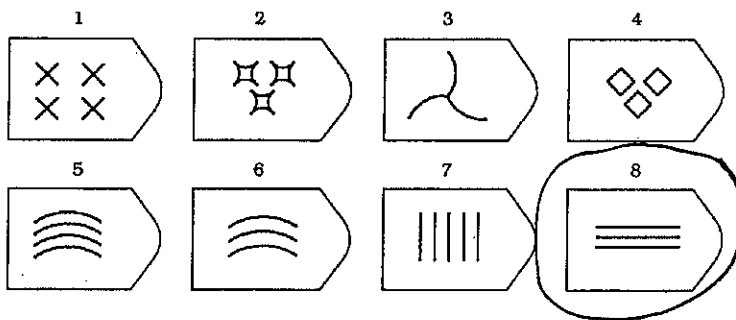
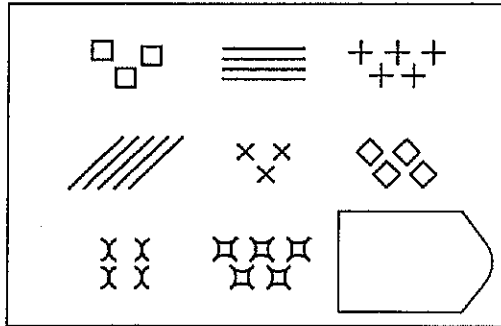
### PATTERN 1



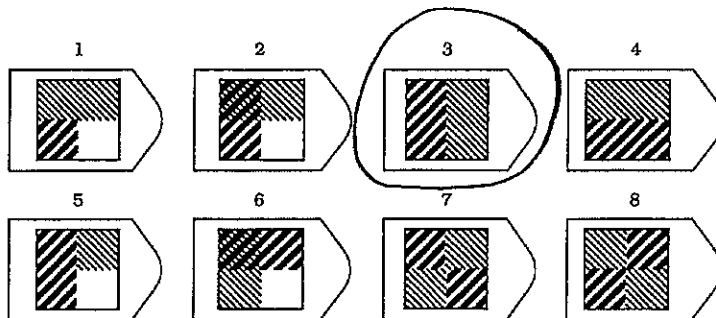
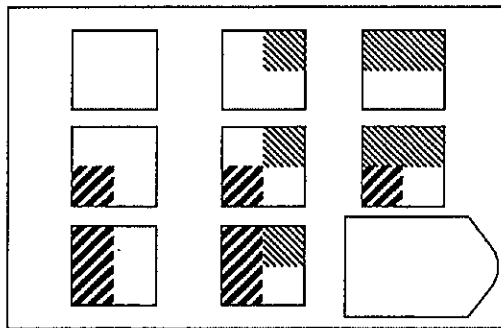
### PATTERN 2

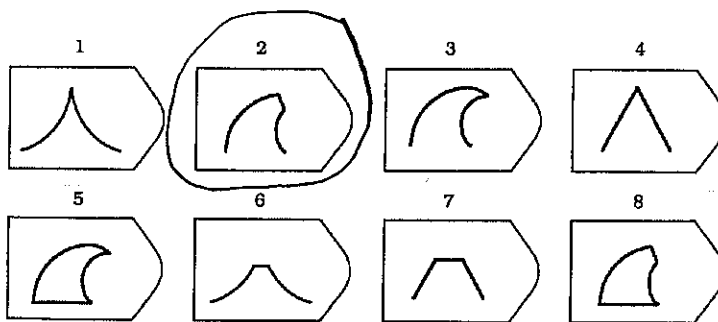
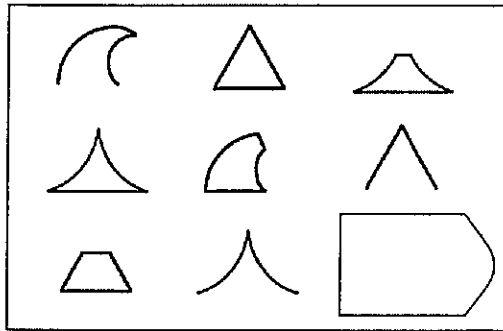


## PATTERN 3



## PATTERN 4



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48238

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☒ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 4 200 5463  
Version B

GROUP

C3

85

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
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4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
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5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
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- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
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7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

$$\frac{1000}{100 - 50} = \frac{1000}{50} = \frac{100}{5} = 20$$

~~8.~~ What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- C
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - ☒ c. The Earth's atmosphere would remain about the same temperature as it is today.
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9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
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~~10.~~ Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- A
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
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## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25

A. Ocean acidification is the process where water <sup>(H<sub>2</sub>O)</sup> and carbon <sup>(CO<sub>2</sub>)</sup> dioxide mix together to form bicarbonate ions <sup>(HCO<sub>3</sub><sup>-</sup>)</sup> and hydrogen <sup>(H<sup>+</sup>)</sup> ions. When the hydrogen ions mix with the water, it causes the water to become more acidic. The acidity of the oceans causes calcium carbonate to break down.

B. An increase in atmospheric carbon dioxide would cause the atmospheric temperatures to increase. With an increase in atmospheric temps, this will also result in an increase in ocean temps. With more CO<sub>2</sub> in the atmosphere, there would be more CO<sub>2</sub> in the water which would cause more ocean acidification. b/c the CO<sub>2</sub> would combine with the H<sub>2</sub>O and create HCO<sub>3</sub><sup>-</sup> and H<sup>+</sup>. A positive feedback would occur b/c ↑ temps would ↑ evaporation and would bring more CO<sub>2</sub> back into the atmosphere. But, a negative feedback would counter this because ↑ temps in the ocean hold less CO<sub>2</sub>.

---

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If the volcanism on Earth suddenly increased dramatically, Earth's atmospheric temp. would decrease. The giant ash clouds would prevent/slow the greenhouse effect. The greenhouse effect occurs when solar radiation (mostly visible light) travels through the GHG layer. When the visible light reaches the earth's surface, it can either be reflected back into space (this does not effect temp) or absorbed & re-emitted as heat/infrared energy. When the heat is re-emitted back to the atmosphere, most of it gets absorbed into the GHG & re-emitted back towards Earth where the process continues. If there was a giant ash cloud in the air, this would keep the sun's energy from reaching the earth where it can be absorbed & turned into heat. Without this process occurring, the temp would be able to decrease b/c less heat is being trapped in the atmosphere

25

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation - moves water from one reservoir to another 1.

degassing - changes the molecule from one form to another.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

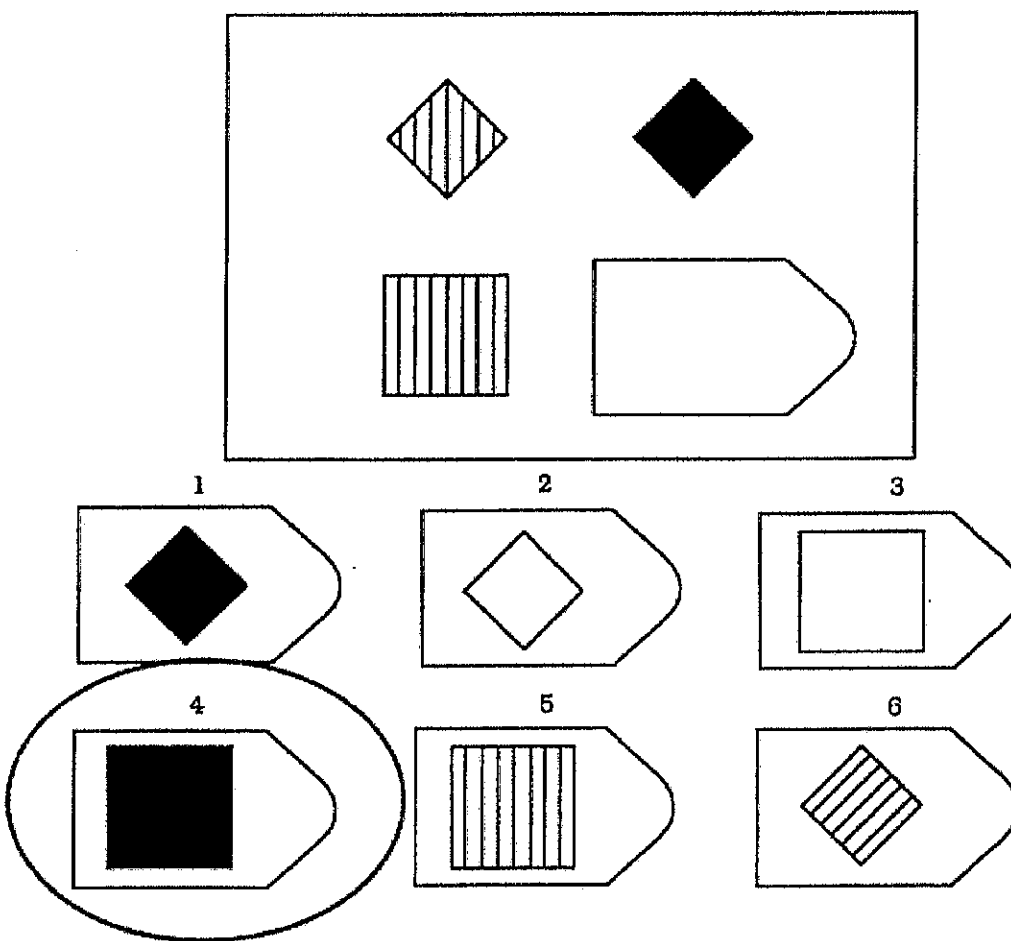


AA2005A03

# Analogical Assessment

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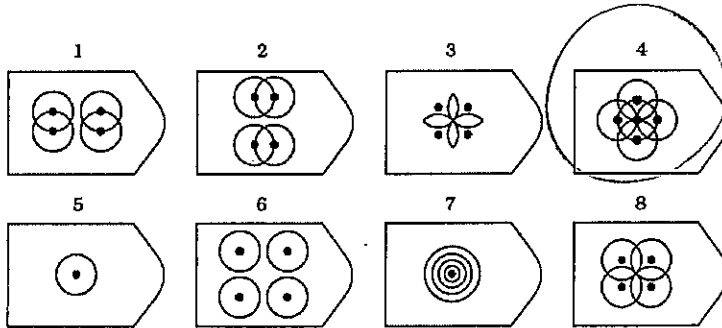
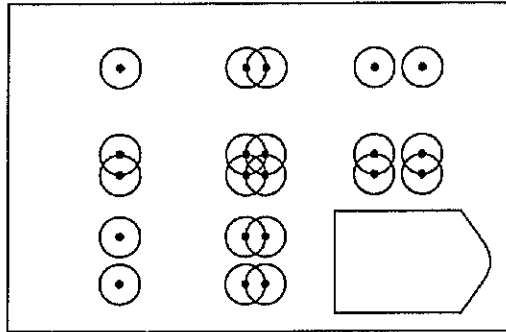


**Answer: 4**

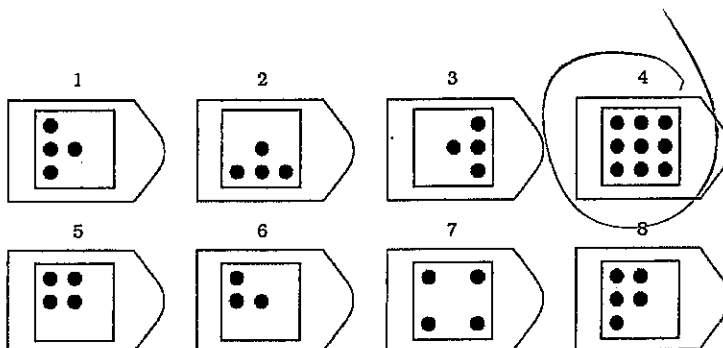
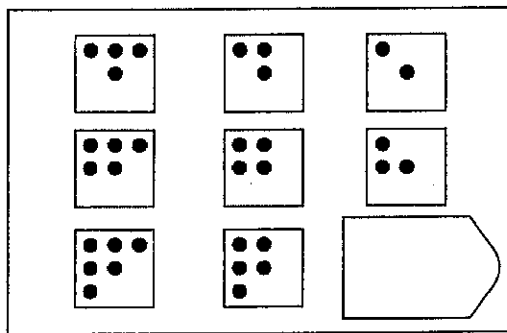
PLEASE CONTINUE ON NEXT PAGE

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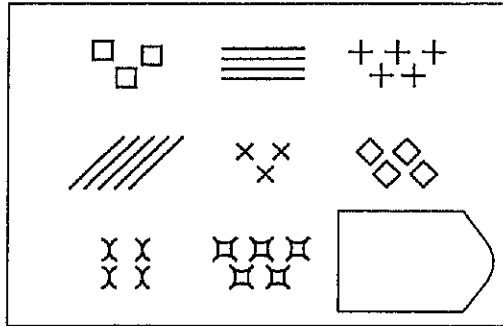


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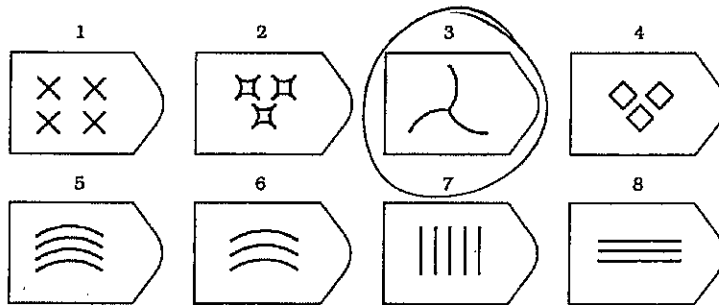




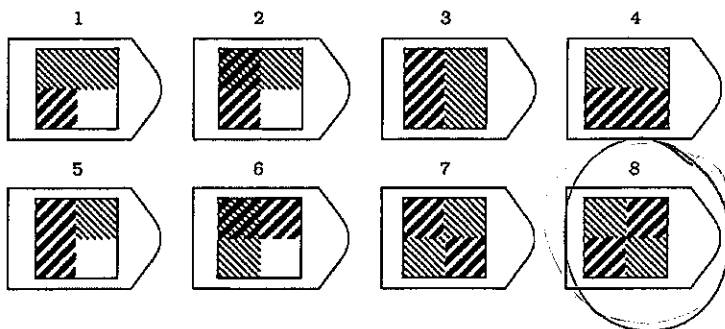
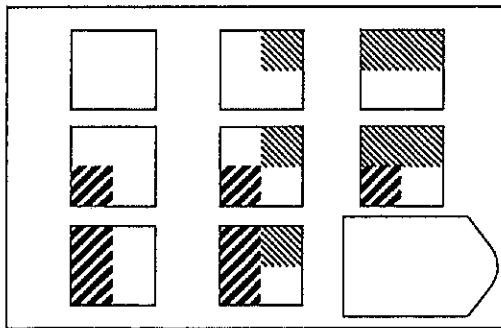
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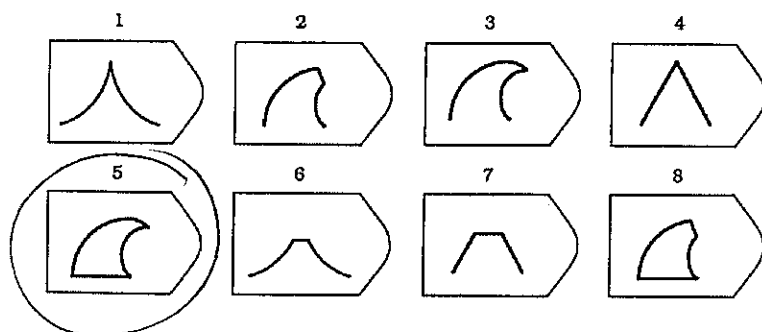
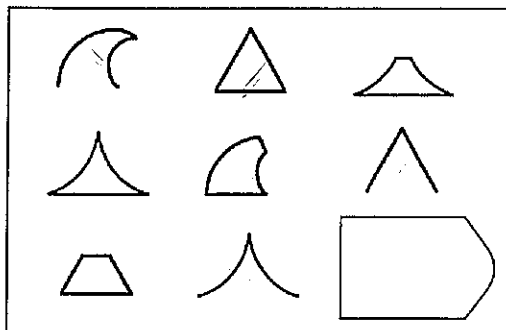


A42005463



## PATTERN 4



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

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Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

A42005463

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

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- ☐ C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
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PLEASE CONTINUE ON NEXT PAGE

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### DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48116

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
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☐ Native American  
☐ Other

STUDENT NAME: A42405167  
Version B

GROUP C3

60

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
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9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

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  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
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~~10.~~ Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would cause ocean acidification to increase. Ocean acidification is when  $\text{CO}_2$  in the atmosphere dissolves into the oceans to form  $\text{HCO}_3^-$  and  $\text{H}^+$  ions. These  $\text{H}^+$  ions cause the water to become more acidic which in turn causes a positive feedback in which to reach equilibrium more  $\text{CO}_2$  dissolves into the ocean which then makes the water more acidic which then breaks down the Calcium Carbonate in shells and limestone underwater which would then slow down the cycle of carbon, snowballing effects of other factors.

20

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If volcanism on Earth suddenly increased and we had more eruption and ash clouds this would cause the temperature of the earth's atmosphere to decrease. The ash clouds would block some of the solar radiation coming into the earth because it would reflect and absorb a lot of radiation coming into the atmosphere. The solar radiation that does get through, some will get trapped in the atmosphere because of the greenhouse effect and now the greenhouse gases including  $\text{CO}_2$  and Methane will trap this radiation and radiate it back to earth. But overall less radiation would be coming in to interact with the greenhouse effect causing a decrease in temperature of the atmosphere.

10

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

evaporation is the transformation of water from liquid to gas while degassing is movement of  $\text{CO}_2$  out.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

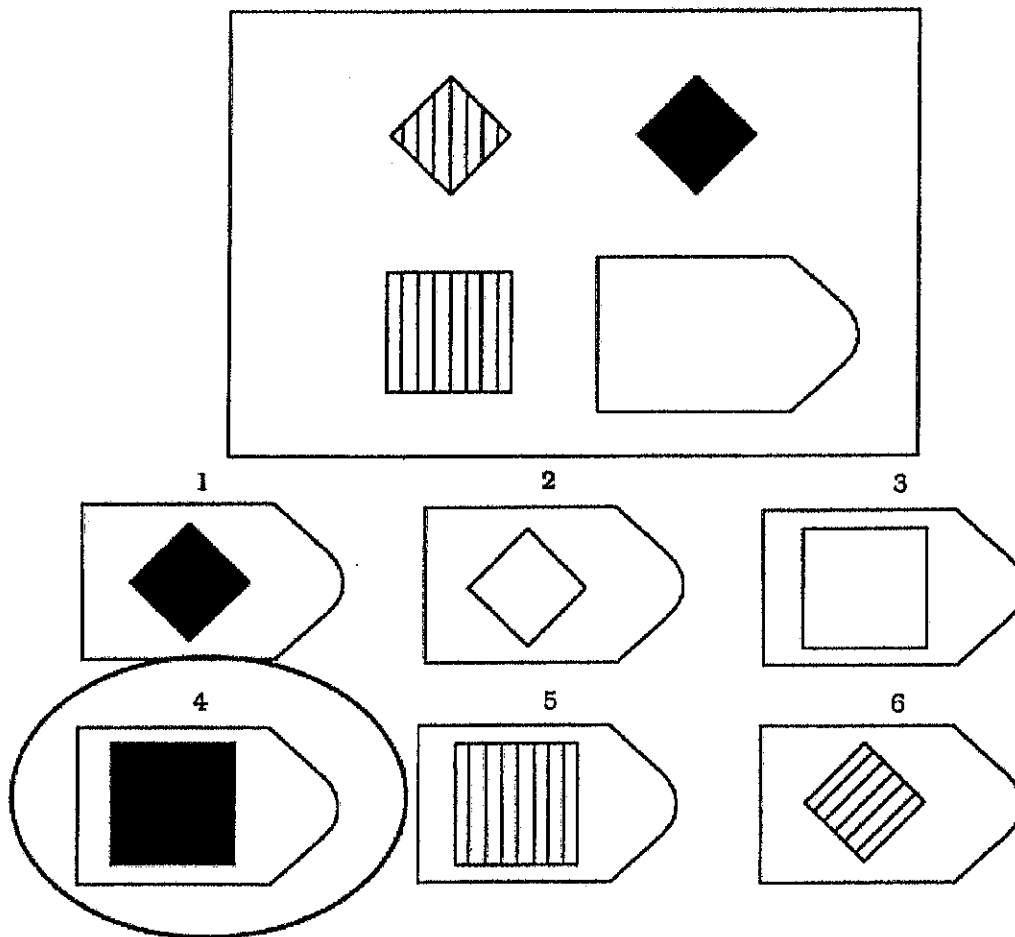
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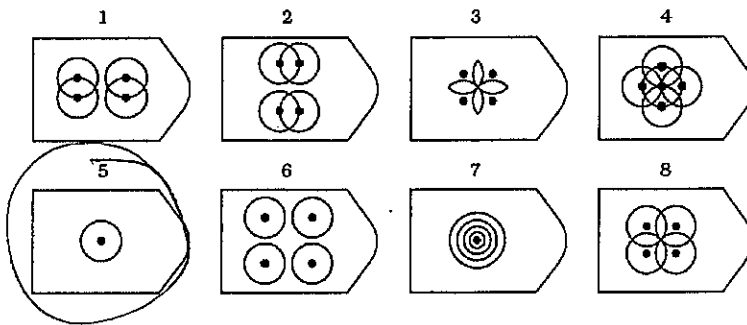
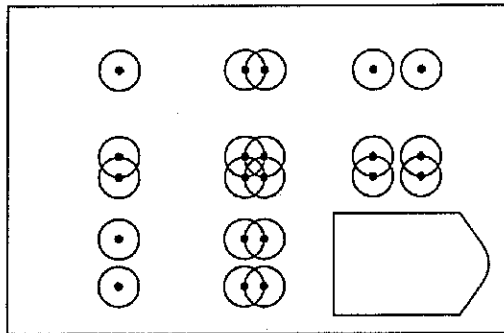


**Answer: 4**

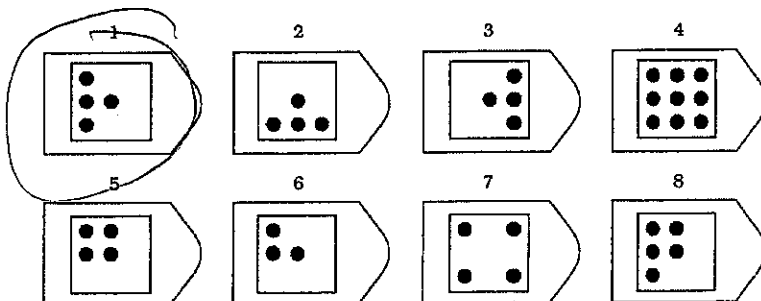
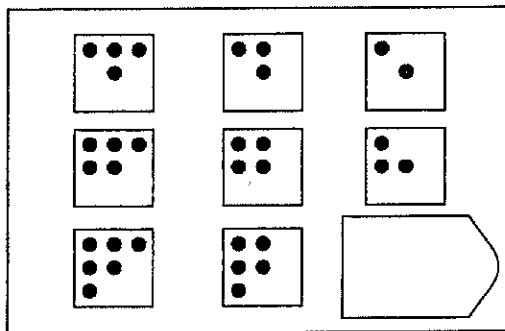
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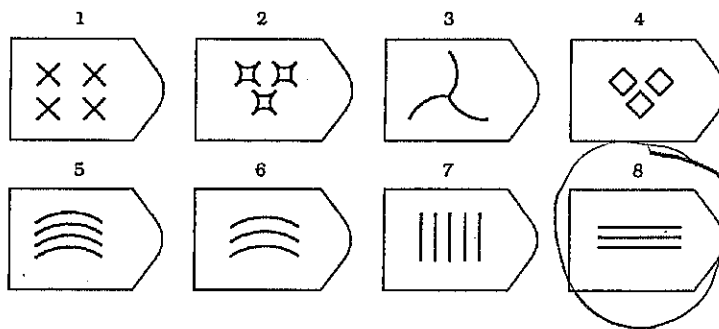
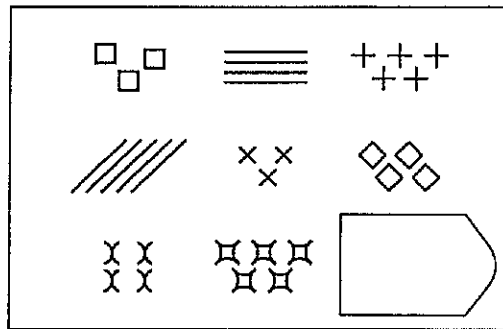
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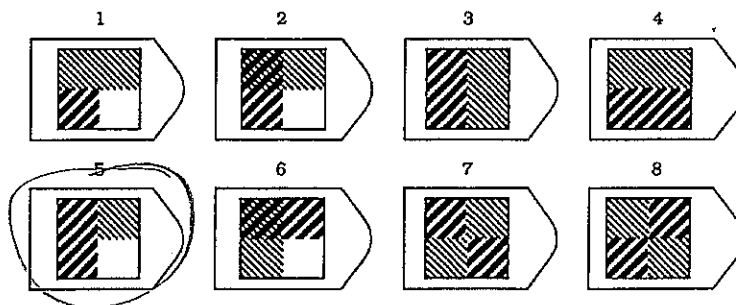
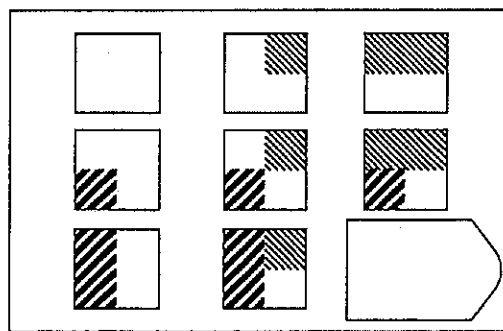
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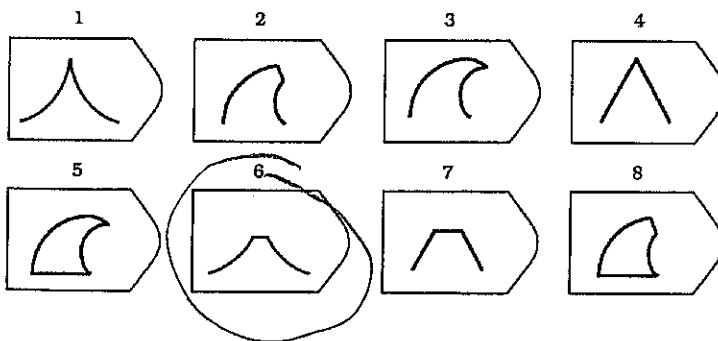
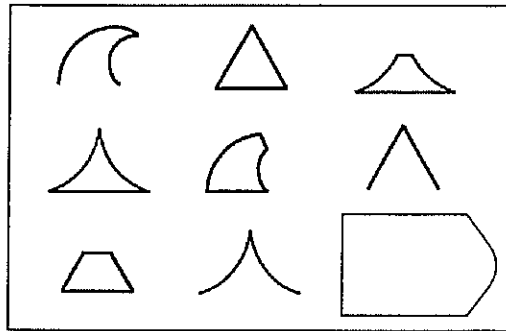


## PATTERN 3



## PATTERN 4



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- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 39527865  
Version B

GROUP: C3

67  
↑ m.c.

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A= erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A= dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- same inflow and out flow and they are equal*
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

CO<sub>2</sub> in atmosphere

↓

ocean

↑

CO<sub>2</sub> + H<sub>2</sub>O → Acidity

ocean acidification

NEGATIVE FEED BACK LOOP

would be if you decreased the amount of CO<sub>2</sub> in the atmosphere which would cause a decrease in the acidity of the ocean. However the oceans are still have high acidic levels so we can't figure out why this is happening. which makes it a negative feed back loop.

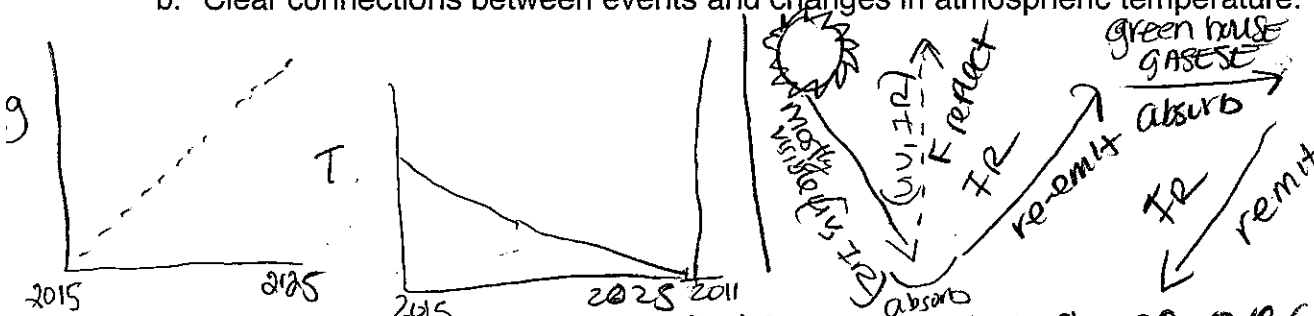
(I tried Dr. Libarkin it)

So an increase in carbon dioxide will increase the amount of CO<sub>2</sub> in the ocean. Because H<sub>2</sub>O and CO<sub>2</sub> come together to form bio-carbonate ions and hydrogen ions. The more hydrogen ions that are in the water will cause the ocean to become more acidic. This can be looked at as a POSITIVE FEED BACK LOOP. Because the more CO<sub>2</sub> in the atmosphere will keep increasing CO<sub>2</sub> in the ocean and which will continue to cause the ocean to be more acidic and keep producing more hydrogen ions.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.



When volcanic ash is left in the atmosphere over long periods of time it will cause the atmospheric temp. to decrease because the sun <sup>(visible light)</sup> cannot shine through all of the volcanic ash in the atmosphere. However greenhouse gases are still being produced. So when the volcanic ash finally does clear up the earth's temp will increase really fast B/c all the heat that was trapped before can now be realised.

### Greenhouse effect

1. Solar radiation enter the earth's atmosphere mostly visible uv light and IR Heat.
2. Earth's Surface convert solar radiation to IR Heat.
3. Earth radiates Heat to atmosphere which is absorbed by gases in the atmosphere and re-emits energy as heat back to Earth and into space.
4. Greenhouse gases in atmosphere absorb the IR Heat emitted by Earth and reemits energy as heat back to Earth and into space.
5. Greenhouse gases reemits heat to Earth.

2 Extra credit (2 points).  
How are evaporation and degassing similar and/or different?

Evaporation is from a liquid to gas they are different and degassing is liquid to ~~air~~ gas

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

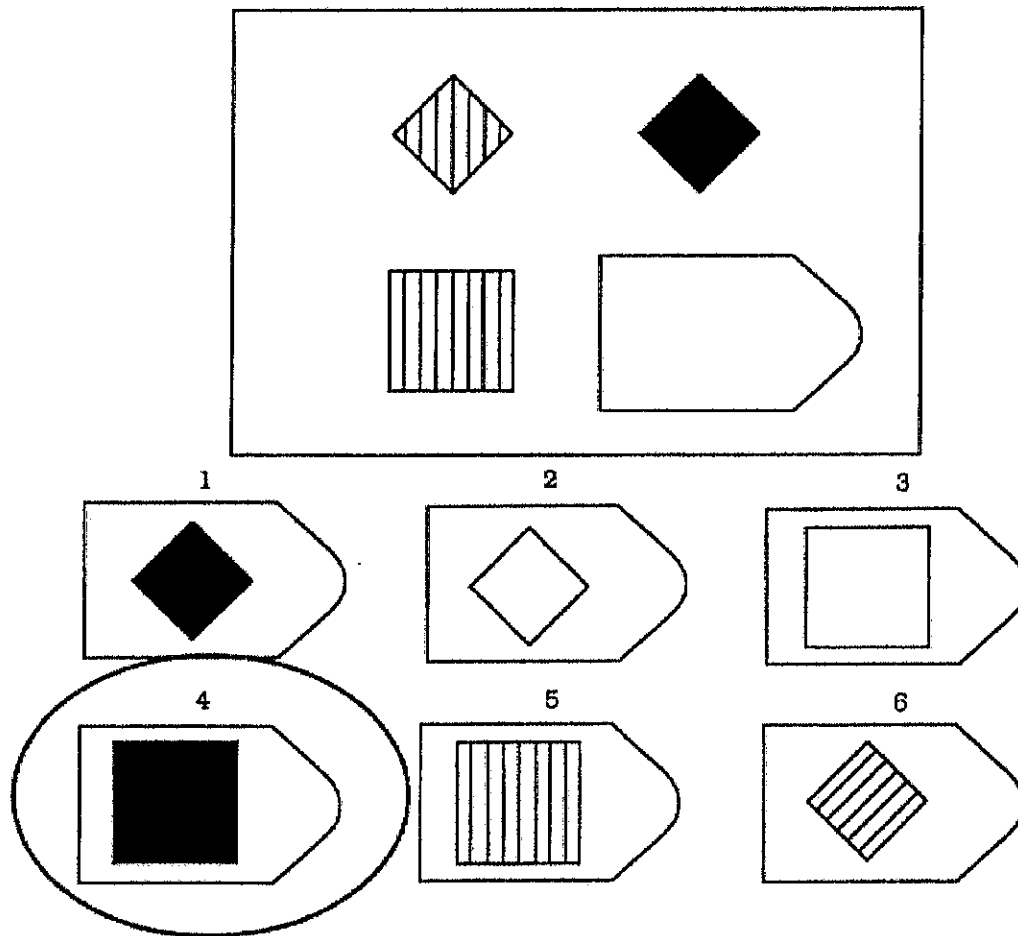
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

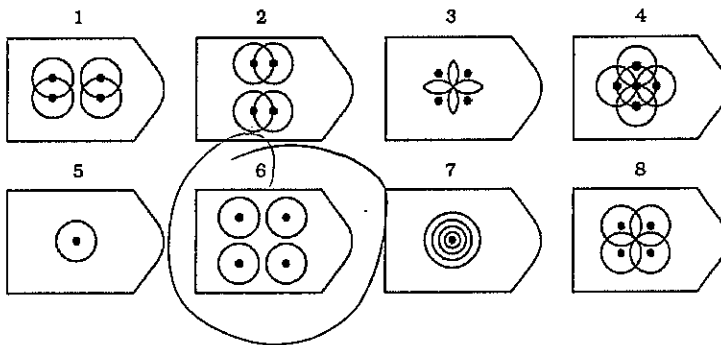
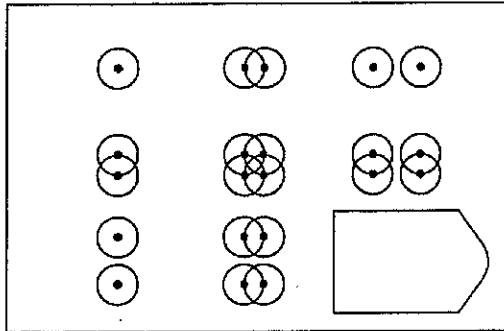


**Answer: 4**

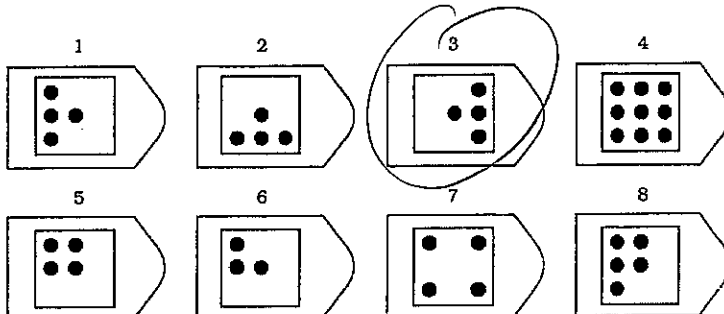
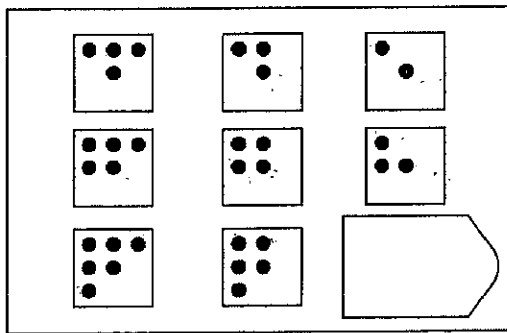
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

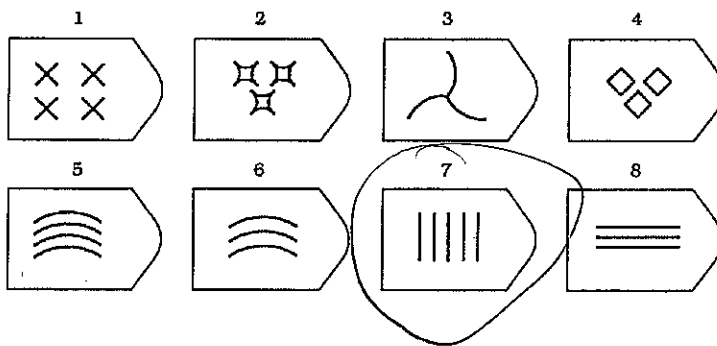
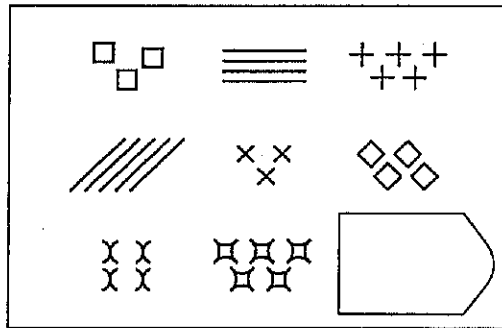


### PATTERN 2

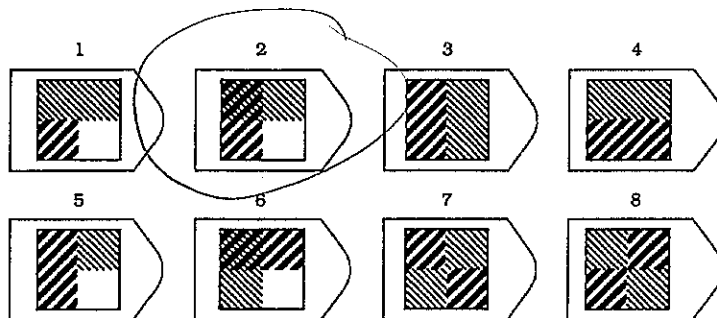
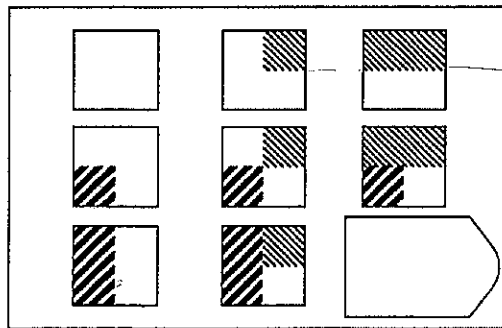




## PATTERN 3

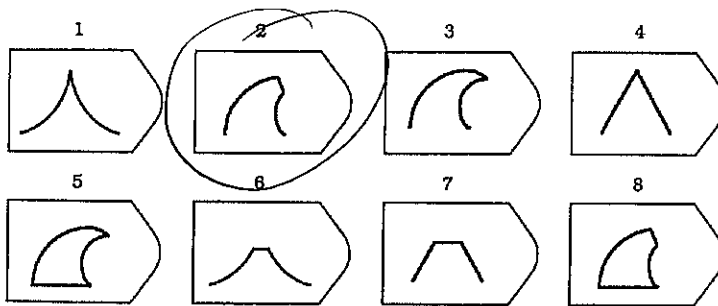
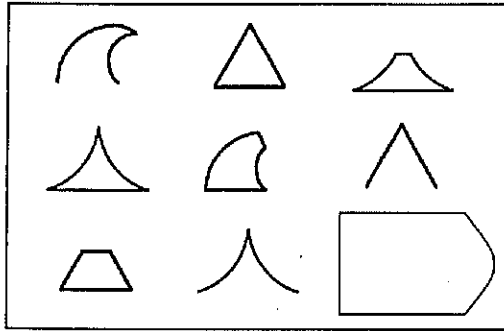


## PATTERN 4



A39527805

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

A39027805

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- ☒ A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- ☒ A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- ☒ D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.

☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.

C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.

D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

☒ A. Getting high. They both involve too much of a chemical influencing the body.

B. Hitting your head. They both involve something that causes headaches.

C. Being sleep deprived. They both involve impaired functions.

D. Eating too much candy. They both involve lack of self-control.

E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

A. Dew forming. They are similar because they both involve a drop in temperature.

B. Blowing up a balloon. They are similar because they both involve becoming less dense.

☒ C. Clouds forming. They are similar because they both involve a phase change.

D. Building a house. They are similar because they both involve building a structure.

### DEMOGRAPHICS

What is your age? 23 years

What is your home zip code? 48840

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☒ African American/Black

☐ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

I was one of the students at  
office hours before the exam

STUDENT NAME: A4228894  
Version A

GROUP: C4

75

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- C
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  $\times$
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere  $\times$
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- C
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition  $\times$
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- B
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- C
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  $\times$
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
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6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- B
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

$$\begin{array}{r|l} A & 20 \\ \hline 5 & 4 \\ \hline B & 10 \\ \hline 5 & 2 \end{array}$$

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B ☒ a. The reservoir will eventually disappear.  
☐ b. The reservoir is not in equilibrium.  
☐ c. The reservoir is growing smaller.  
☐ d. The reservoir's residence time is 10 years.

$$\frac{1000}{100} = 10$$

$$\frac{1000}{50} = 20$$

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase  
☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- D ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
☐ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- B ☐ a. The Earth's atmosphere would become colder than it is today.  
☒ b. The Earth's atmosphere would become warmer than it is today.  
☐ c. The Earth's atmosphere would remain about the same temperature as it is today.  
☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

20

Ocean acidification is the process by which  $\text{CO}_2$  gets into the ocean and makes it more acidic. As people, for example, burn more fossil fuels, more  $\text{CO}_2$  is emitted into the atmosphere. The  $\text{CO}_2$  can then get into the ocean and disrupt marine life by raising the pH level. Thus the oceans become more acidic.  $\Rightarrow$   $\text{CO}_2$  increase speeds up ocean acidification.

The greenhouse effect plays a large role in ocean acidification. When the sun's visible light hits earth, the unabsorbed infrared radiation goes up into the atmosphere and hits the greenhouse gases only letting some escape into space. The ones that stay with the atmosphere continue to warm the earth. As the earth warms, there is more  $\text{CO}_2$  in the atmosphere and  $\text{O}_2$  is being taken out through photosynthesis, etc. and causes the oceans to warm. w/ less  $\text{CO}_2$  being sequestered, there are more greenhouse gases and the process keeps over a positive feedback loop which causes more  $\text{CO}_2$  in atmosphere & raises acidity in oceans.

A negative feedback is when an increase in  $\text{CO}_2$  warms the atmosphere through greenhouse effect which causes more evaporation in atmosphere which causes temperatures to decrease because of cloud cover which would decrease amount of  $\text{CO}_2$  staying in atmosphere eventually decreasing the acidity of the ocean.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect starts w/ the sun's rays hitting the earth. Visible light goes through atmosphere, some rays getting absorbed, some getting reflected and some bouncing off ground + going back up into atmosphere. When this happens some of the infrared will go out of atmosphere, while others will hit greenhouse gases and go right back down to the surface to warm up the earth. Methane, CO<sub>2</sub>, etc. are the greenhouse gases that sit in atmosphere and cause this effect. It helps to keep earth at a more consistent temperature between day and night.

same

Volcanism is increased by more carbon dioxide in atmosphere and higher temperatures. The more greenhouse gases like CO<sub>2</sub> in atmosphere, the more the earth's temperature will increase leading to more volcanism. The more volcanism can cause earth's temperature to briefly cool through large ash clouds, by blocking sun's rays, but ultimately the composition matter in ash will cause earth to increase temperature because it will increase amount of greenhouse gases.

20

Extra credit (2 points).

- How are evaporation and degassing similar and/or different?

Evaporation is the water molecules evaporating from biosphere/hydrosphere to atmosphere. Degassing is calcium or carbon going from biosphere/hydrosphere or lithosphere to atmosphere. Carbon is usually as gas, H<sub>2</sub>O



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

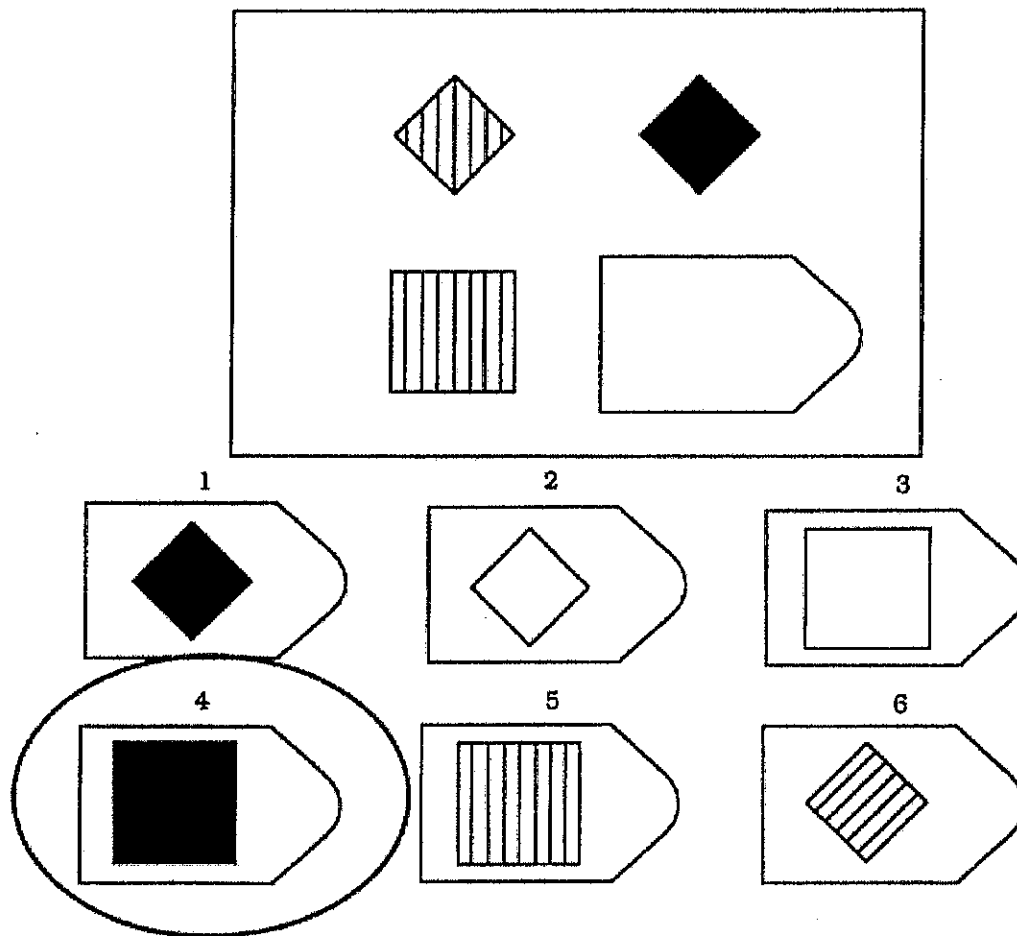
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

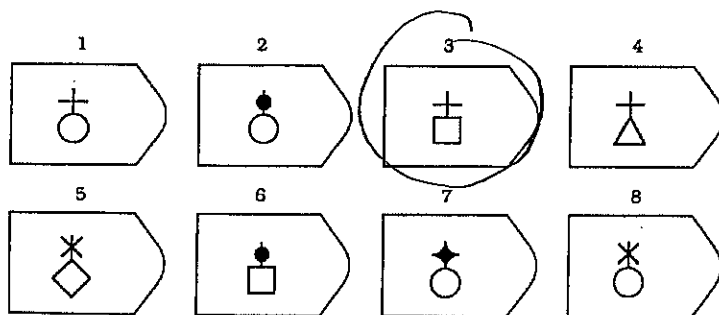
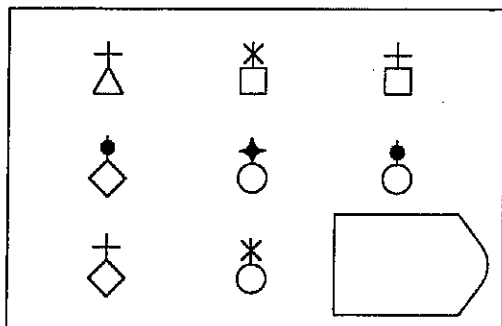


**Answer: 4**

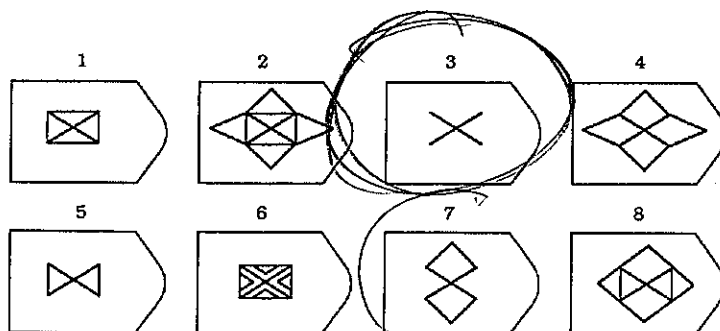
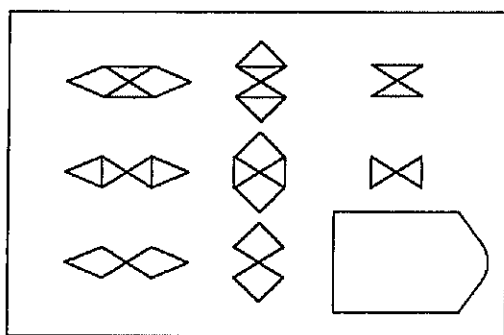
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Please choose the image that best completes each of the following patterns.

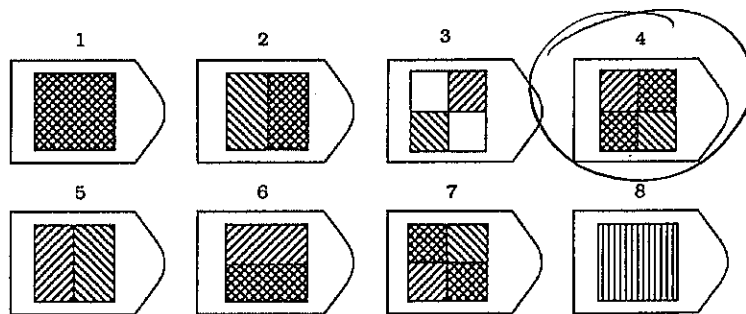
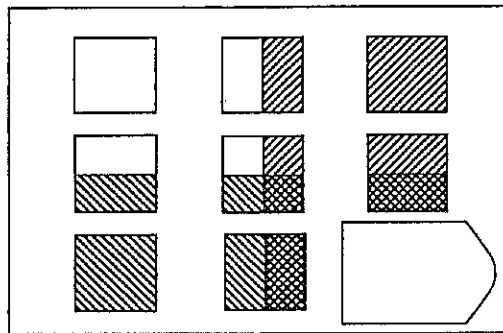
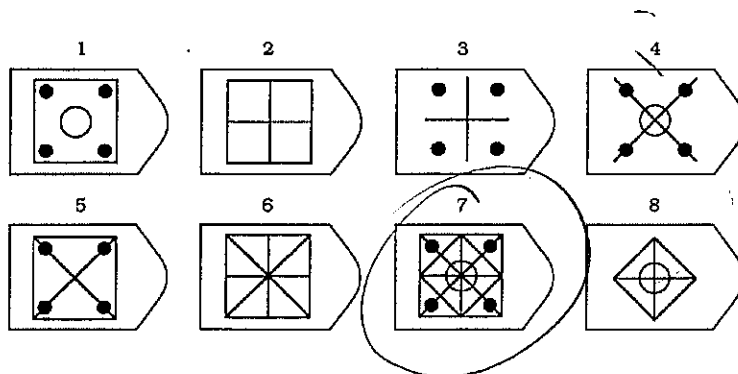
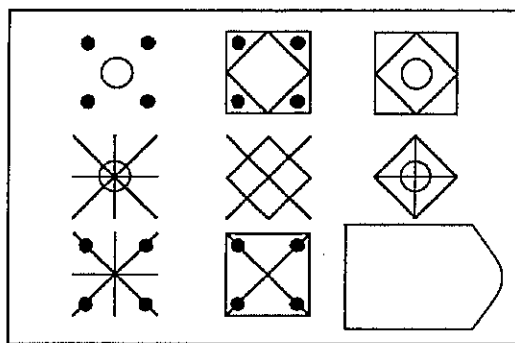
### PATTERN 1



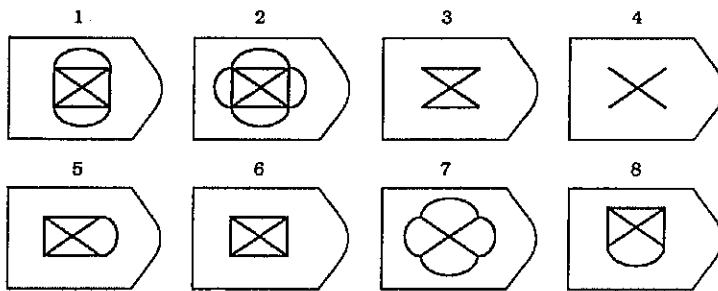
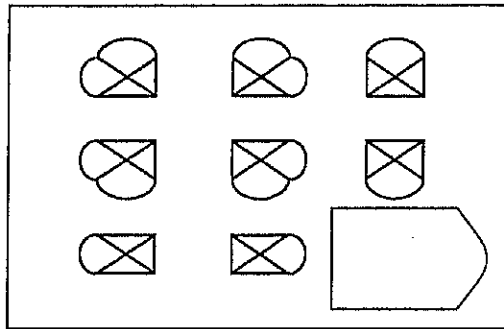
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 60558

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A42460239  
Version A

GROUP: C4

75

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. ~~Melting of ice sheets resulting in more visible energy from the Sun being absorbed~~
  - b. ~~Melting of permafrost resulting in more methane escaping into the atmosphere~~
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. ~~An increase in desert formation resulting in more dusting blowing into the atmosphere~~
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. ~~An increase in ocean temperature due to an increase in atmospheric carbon dioxide.~~
  - b. ~~A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.~~
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

$$RT = \frac{\text{amount}}{\text{influx}(\text{outflux})}$$

A

B

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

1. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- ☒ D
- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - ☒ d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☒ C
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- ☒ d
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

24

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25

An increase in atmospheric carbon dioxide will cause an increase in  $\text{CO}_2$  in the oceans. This increase of  $\text{CO}_2$  in the ocean will increase the ocean's pH level. However, it is also important to consider temperature because colder water can absorb more  $\text{CO}_2$  than warm water.

★ If the water is colder, then it will absorb more  $\text{CO}_2$  in the ocean and thus more  $\text{CO}_2$  in atmosphere — positive feedback loop.  
increases  $\text{CO}_2$  —

★ An increase in  $\text{CO}_2$  in ocean → increase temperature → warm water can't absorb as much  $\text{CO}_2$  as cold water.

↖ This is an example of a negative feedback loop at first because the increase of  $\text{CO}_2$  in the ocean ↑ increase the temp which doesn't allow it to take in as much  $\text{CO}_2$ . It is negative because it cause a change in the feedback loop and halts/changes the original process.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect is caused by energy derived from the sun heating Earth's surface. Energy from the sun mostly comes in visible wave lengths and thus is easily able to pass through Earth's atmosphere. Once it hits earth's surface, some energy might bounce back into the atmosphere and not affect earth's atmospheric temperature. <sup>Visible</sup> Energy that is absorbed in the earth is transformed into infrared (heat) energy. This energy is then emitted into the atmosphere. Greenhouse gasses are a very good recipient of infrared energy and in a sense "trap" this heat. This heat is then re-emitted in all directions and is responsible for heating our Earth.

Large ash clouds block the solar radiation coming down from earth, not allowing solar radiation to hit earth's surface. This causes a global cooling.

25

Extra credit (2 points).

- \* How are evaporation and degassing similar and/or different?

Evaporation and degassing changes matter into gasses in the atmosphere. Evaporation is in the water cycle, while Degassing is in the carbon cycle.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

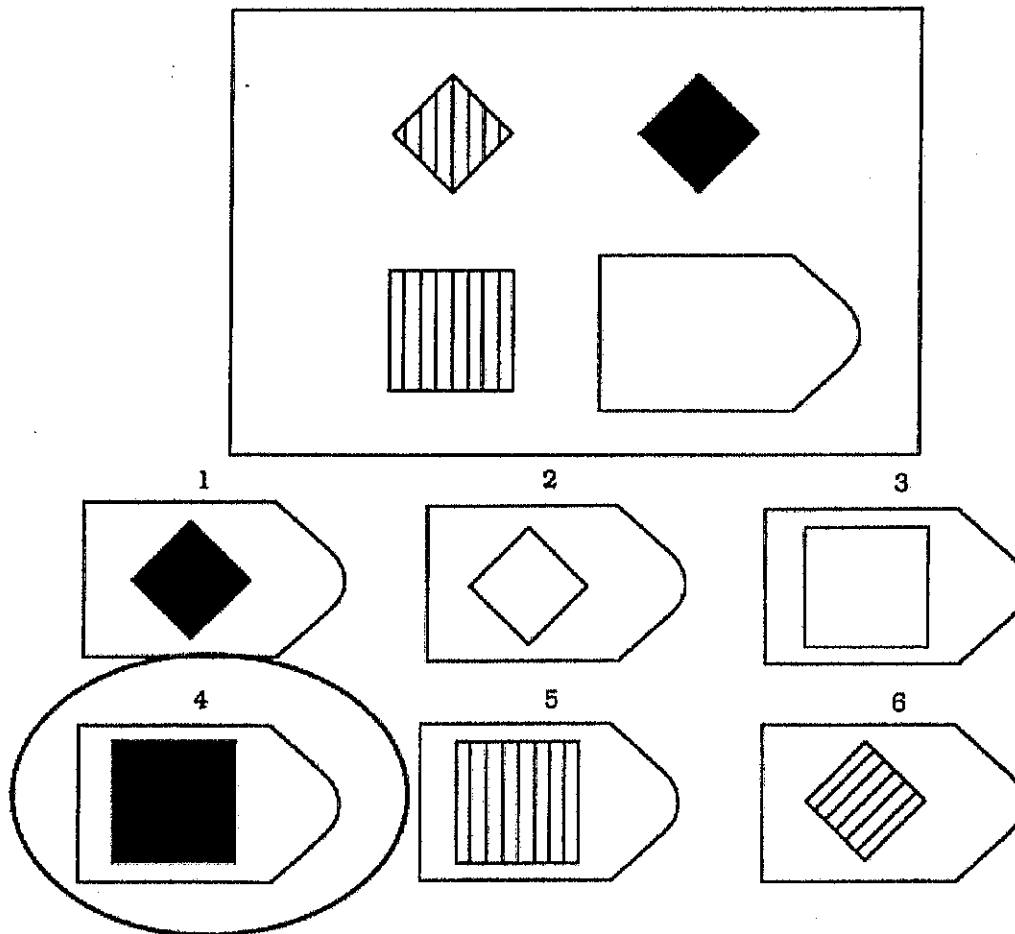
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

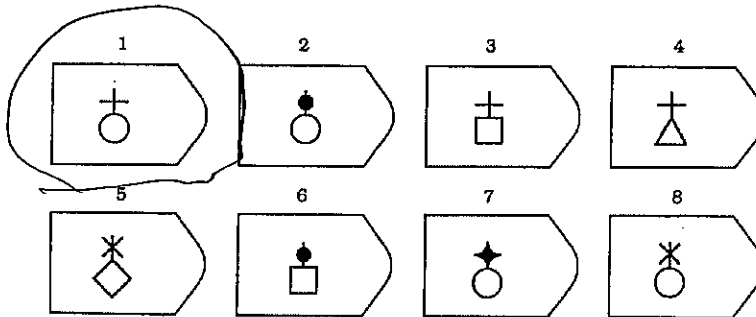
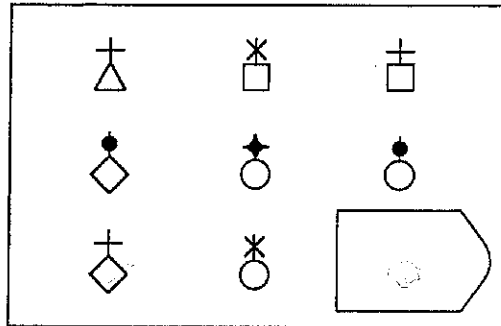


**Answer: 4**

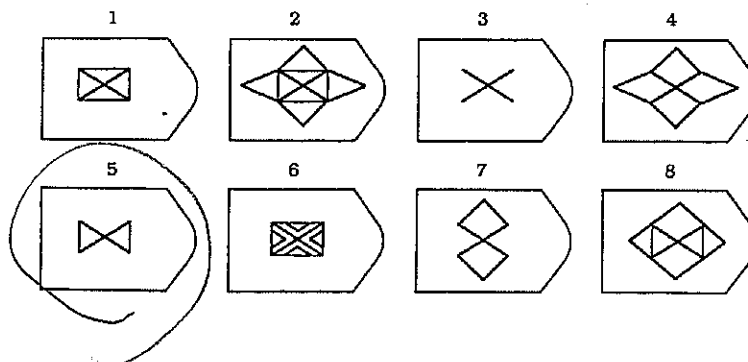
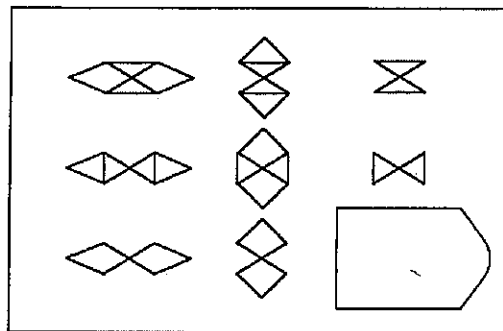
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

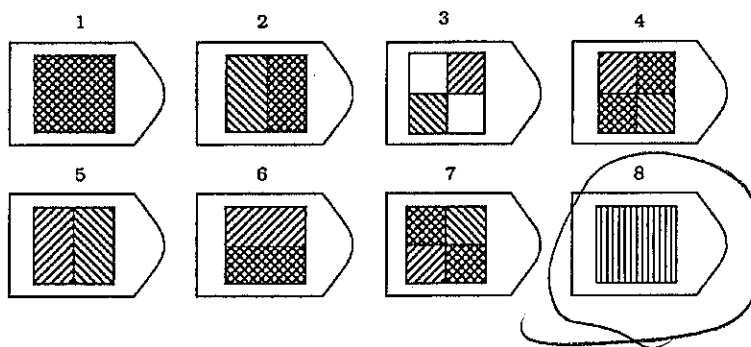
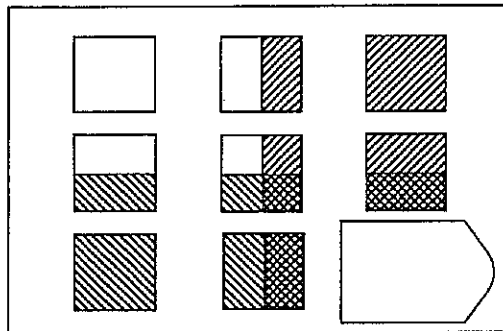
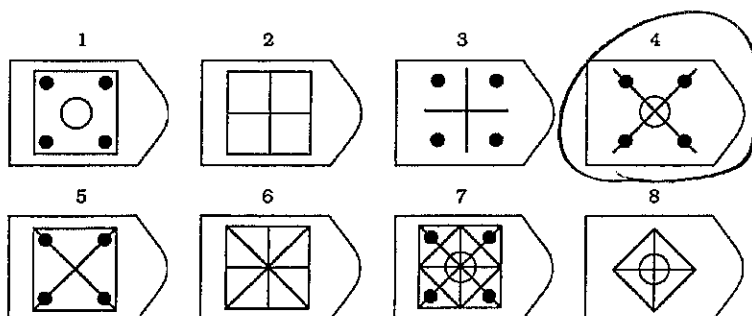
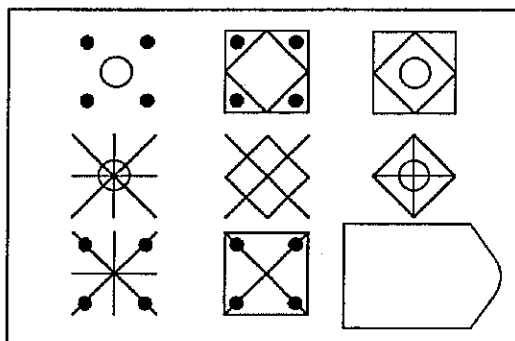


### PATTERN 2

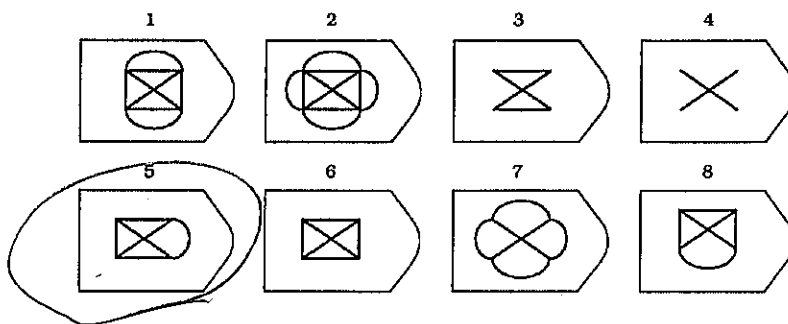
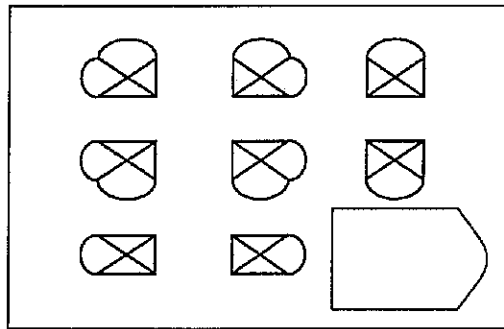


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**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

**Please choose the best analogy to each of the following statements.**

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

☒ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

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C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

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A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

*PLEASE CONTINUE ON NEXT PAGE*

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.

☒ A. The plumber fixed the pump that had burst and flooded the basement.

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---

Please choose the response that is closest to an analogy that you might make.

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☐ C. Blowing bubbles. They are similar because they both float until they eventually pop.

☒ D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

☒ A. Getting the flu. They are similar because they are both caused by viruses.

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☐ C. Getting the flu. They are similar because they are both caused by not washing your hands.

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## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? \_\_\_\_\_

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☒ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

STUDENT NAME: A43296853  
Version A

GROUP: C4

80

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - ☒ c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
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  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
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  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
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  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
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6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

$$\frac{2x}{=} \quad \frac{x}{=}$$

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

$$\frac{1000}{100} \qquad \frac{1000}{50}$$

- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - ☒ c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
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  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - ☒ b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric  $\text{CO}_2$  would affect ocean acidification by causing it to increase. Ocean acidification is the process by which the pH levels of the oceans increase due to  $\text{CO}_2$  in the atmosphere dissolving (or going through dissolution) and becoming  $\text{CO}_2$  gas in the ocean. When the  $\text{CO}_2$  mixes with water it forms  $\text{HCO}_3^-$  (bicarbonate ions) which are used to produce the shells of ocean organisms. This would be a positive feedback loop in that it implies there is more  $\text{CO}_2$  <sup>in flux of</sup> in the atmosphere which leads to more  $\text{CO}_2$  in the oceans <sup>or a greater</sup> and more ocean acidification due to the release of more of the greenhouse gas, yet there would also be a trend of a negative feedback loop because as  $\text{CO}_2$  in the atmosphere increases temperature will raise and ocean temperatures will raise also, and warmer water will absorb less  $\text{CO}_2$ .

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

a) The greenhouse effect is the process by which the earth is heated. The sun emits visible energy which passes through the earth's atmosphere to be absorbed by the earth's surface. When this visible energy reaches the earth it can be reflected or absorbed. If it is reflected it goes back out into space, but if it is absorbed it is converted to thermal (infrared) energy and readmitted by the earth's surface. This energy can either pass back out into space, or be absorbed by greenhouse gases such as  $\text{CO}_2$ , methane, or ozone in which it charges the gases molecules and is readmitted back to earth. If volcanism were to increase then the sulfuric ash could settle outside of the earth's atmosphere, thus reflecting the sun's visible energy is not allowed to enter the atmosphere decreasing temperatures. Yet, the  $\text{CO}_2$  that forms in the bubbles of magma would be released into the atmosphere and causing an increase in global warming, and ocean acidification. These are opposing trends.

25

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation & degassing are the same in that when water evaporates <sup>to</sup> is still water in liquid form, and when  $\text{CO}_2$  goes through degassing from the ocean to the atmosphere it is still  $\text{CO}_2$  in gas form.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

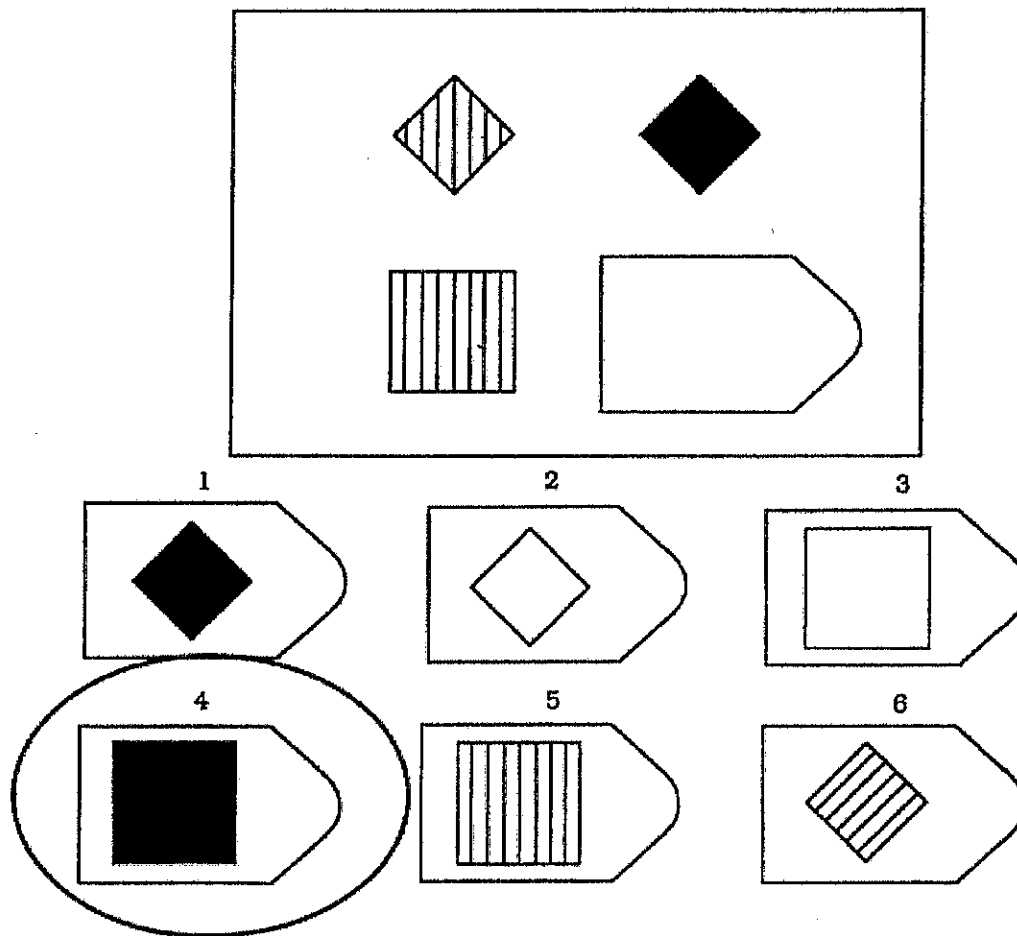
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

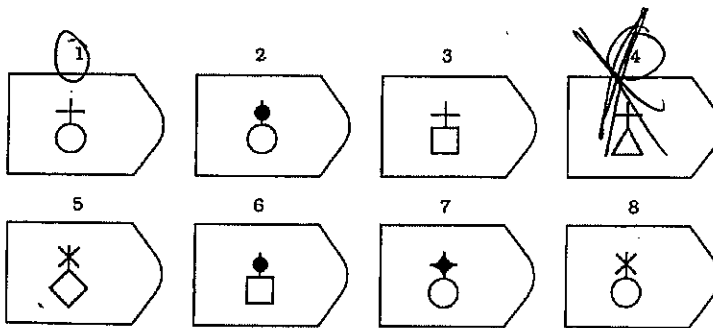
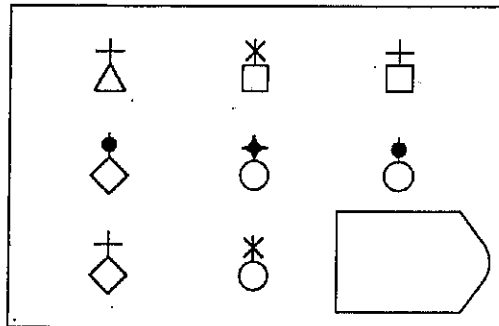


**Answer: 4**

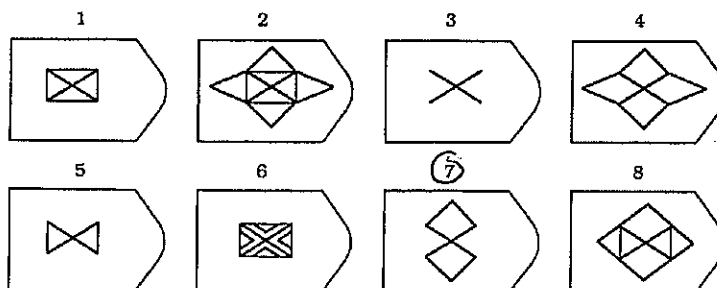
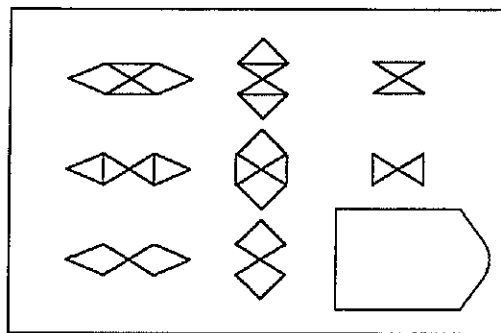
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Please choose the image that best completes each of the following patterns.

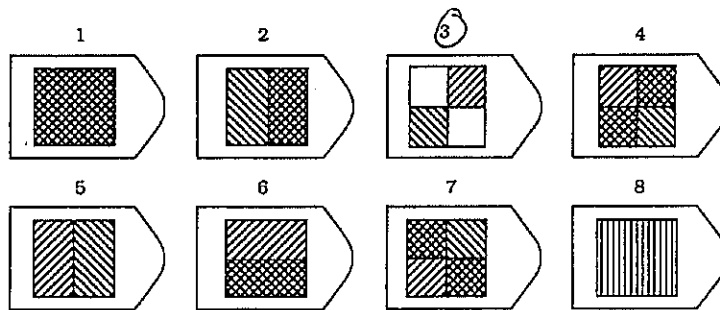
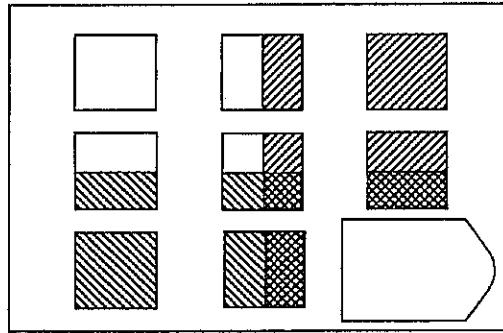
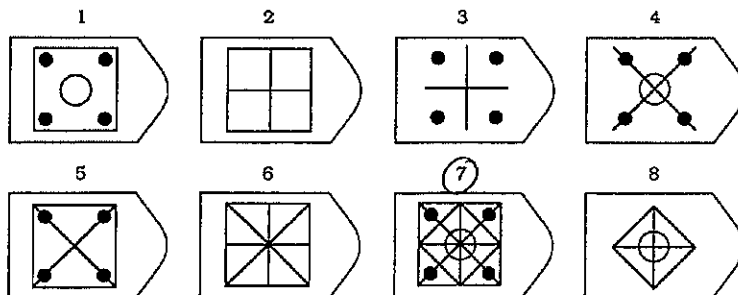
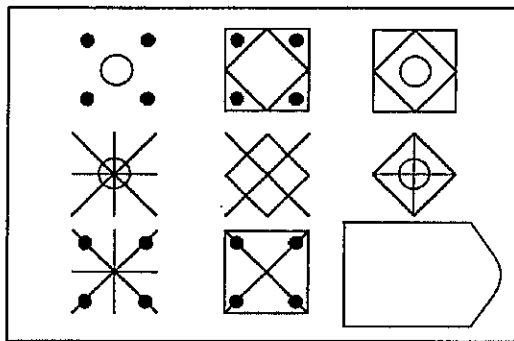
### PATTERN 1



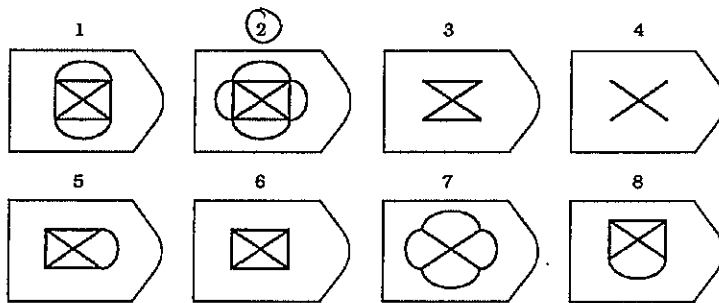
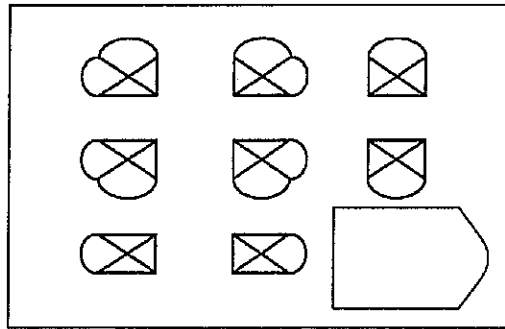
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- ☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48092

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☒ African American/Black  
☐ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other



STUDENT NAME: A-40659482  
Version B

GROUP: C5

47

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- B
- a. The Earth's atmosphere would become colder than it is today.
  - ☒ b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

~~10.~~ Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- C
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

When there is an increase in atmospheric carbon dioxide, the amount of  $\text{CO}_2$  in the ocean will also rise. The increase of  $\text{CO}_2$  in the ocean will raise the pH level which would increase ocean acidification. WHY?

However, the increase of  $\text{CO}_2$  in the ocean can also have effects on the environment that cause negative feedback which will have the reverse effect on the trend. But this can also be the other way around. The increase may also have effects on the environment that lead to ocean acidification increasing even faster. This would be a positive feedback.

2

5

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

An increase in volcanism would cause an increase in ash clouds entering the atmosphere. The resulting clouds would allow less visible light to reach the surface of the earth, which would make smaller the amount of radiation from the sun that the planet could absorb. Because of this decrease in solar radiation, the earth would begin to cool.

An increase in volcanism would cause an increase in ash clouds entering our atmosphere. The resulting clouds would allow less visible light to reach the surface of the earth, which would make smaller the amount of radiation from the sun that the planet could absorb. Because of this decrease in solar radiation, the earth would begin to cool.

10

10

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Both involve gas going into the atmosphere originating from a liquid. However, evaporation is a change of state, whereas degassing is

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

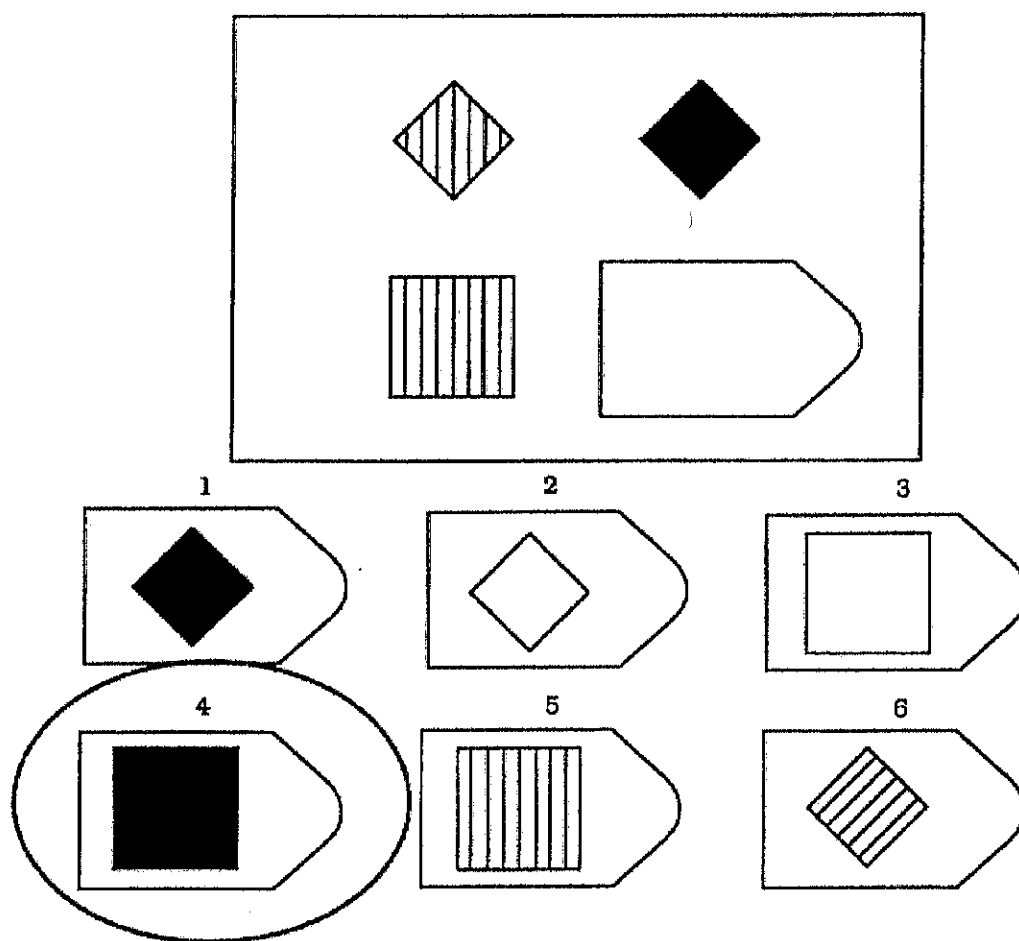
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

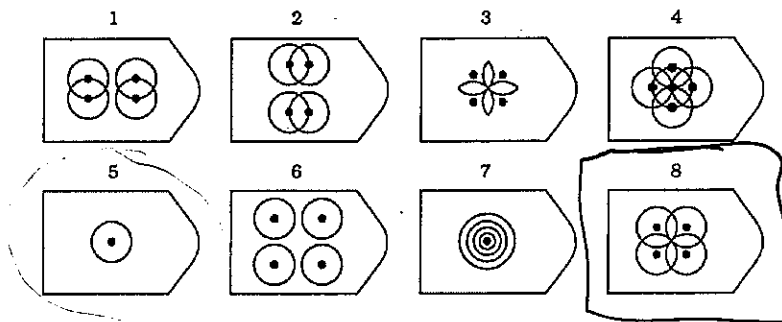
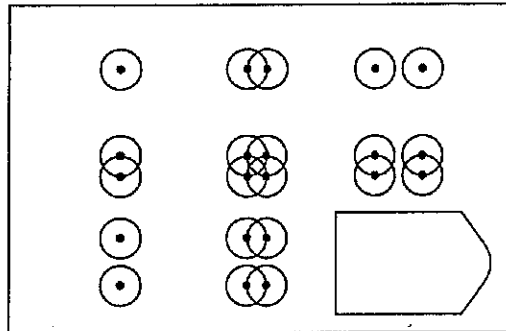


**Answer: 4**

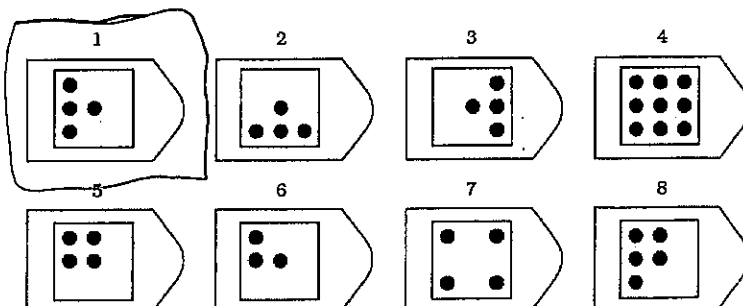
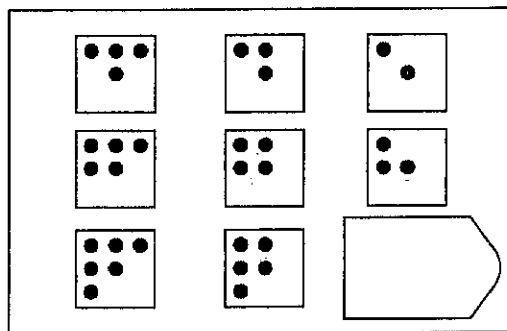
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

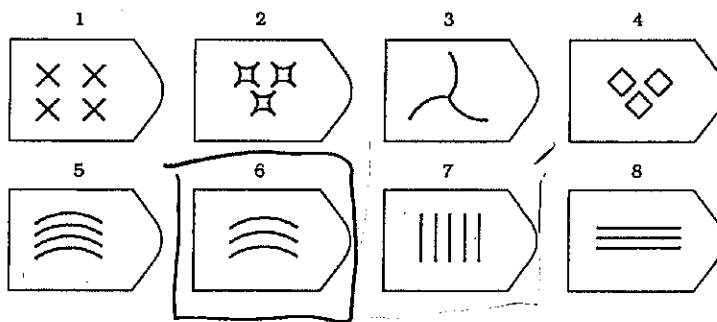
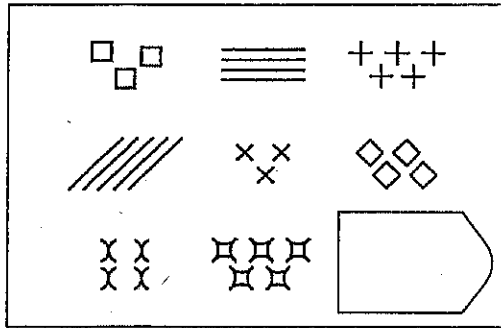
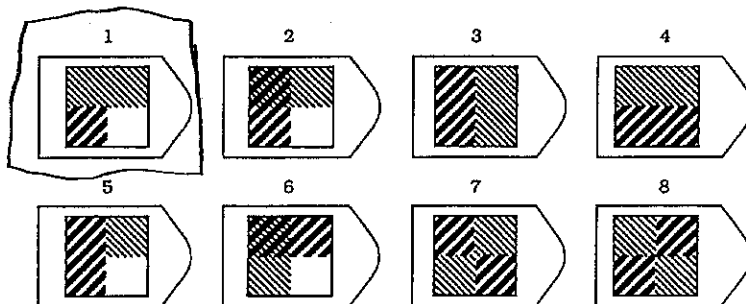
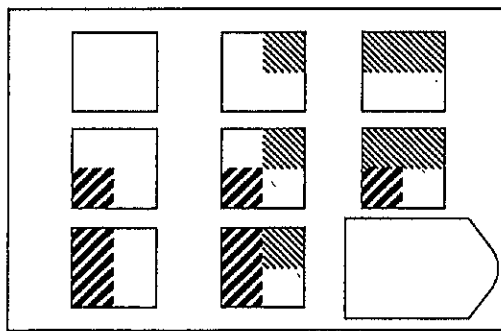


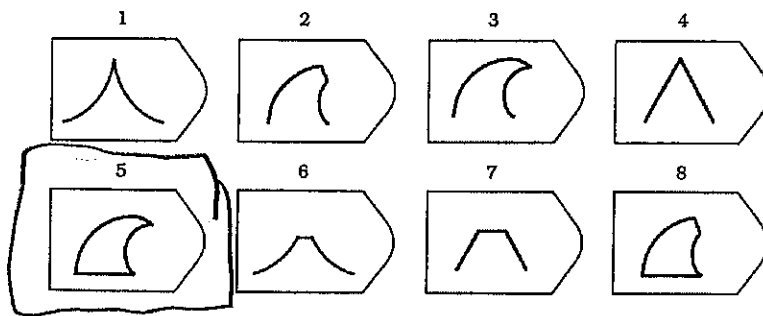
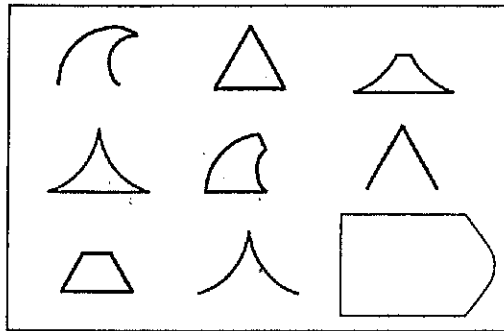
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- ☐ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- ☐ C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- ☐ D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
- ☐ B. Hitting your head. They both involve something that causes headaches.
- ☐ C. Being sleep deprived. They both involve impaired functions.
- ☐ D. Eating too much candy. They both involve lack of self-control.
- ☐ E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- ☐ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☐ C. Clouds forming. They are similar because they both involve a phase change.
- ☐ D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 23 years

What is your home zip code? 48084

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☒ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 40004959  
Version B

GROUP: C5

67

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - ☒ c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

$$\begin{array}{r} 1000 \\ + 50 \\ \hline \end{array}$$

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- C
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

A40004959

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is important to understand because it can have profound ecological ramifications. Ocean acidification occurs when carbon dioxide is dissolved into the ocean. The carbon dioxide molecule bonds with the water molecule, leaving a  $\text{HCO}_3^-$  molecule and a spare hydrogen ion ( $\text{H}^+$ ). Since neither of these are water any longer, this causes the oceans' pH to drop, increasing the levels of acidity in the oceans. Therefore, an increase of atmospheric levels of carbon dioxide would also lead to an increase in ocean acidification. In a positive feedback loop, the levels of acidity in the oceans goes beyond the tolerance of certain plants and animals. They die because of this. This in turn would increase the levels of  $\text{CO}_2$  in the oceans because of the respiration that occurs during bacterial decomposition; this also causes the acidity level to increase because of all the  $\text{CO}_2$ , causing more organisms to die and decompose. Moreover, in a negative feedback loop, such as, if the atmospheric levels of  $\text{CO}_2$  were to drop the opposite would occur. The inflow of  $\text{CO}_2$  would decrease and the outflow would stay the same, bringing the system closer to equilibrium.

OK 25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

I feel that this could go either way depending on the amount of CO<sub>2</sub> and methane released by the volcanoes, but it would more likely result in the decreasing of the earth's temperature. Volcanoes affect atmospheric temperatures in many ways. Firstly, if the clouds released are particularly ash-filled rather than full of greenhouse gases like CO<sub>2</sub> and methane, this could cause an increase of the Earth's temperature. However, if the volcano has large ash clouds, this could decrease the Earth's temperature, by stopping a large part of the Sun's radiation from reaching the surface. The greenhouse effect is a natural process through which the Sun's heat is trapped in the atmosphere by the gases present. Without this effect, life would be impossible on Earth. Furthermore, as previously stated, the volcanoes' ash-filled clouds would cool the Earth by stopping the Sun's heat from reaching the surface. The volcanoes would erupt and the ash clouds would blanket the Earth, and the solar radiation levels ~~was~~ reaching the surface would decrease, causing the Earth to cool. This happened in the 1850s when Krakatoa erupted in the Indian Ocean. The skies were darkened and weather patterns changed.

10

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are similar in that they both involve gas leaving a liquid. However, evaporation involves a phase change, from liquid to gas, whereas degassing is simply a gas leaving a liquid.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

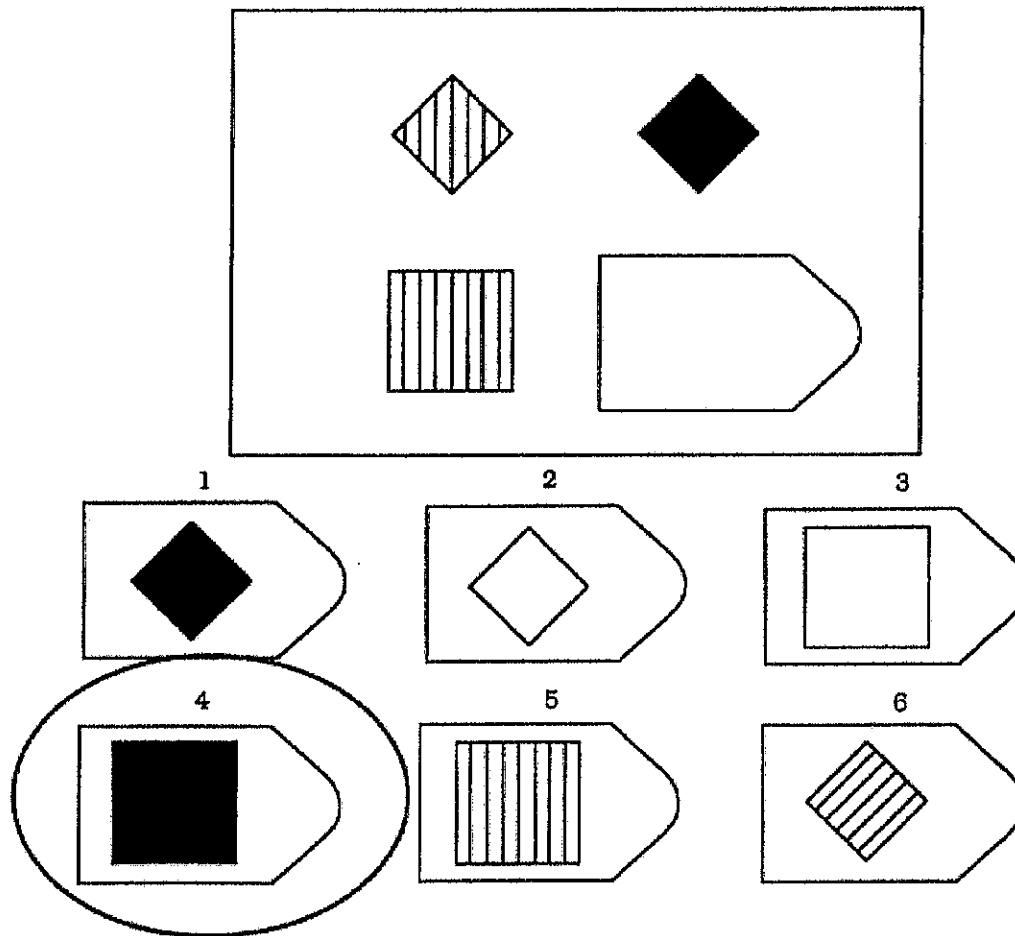
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

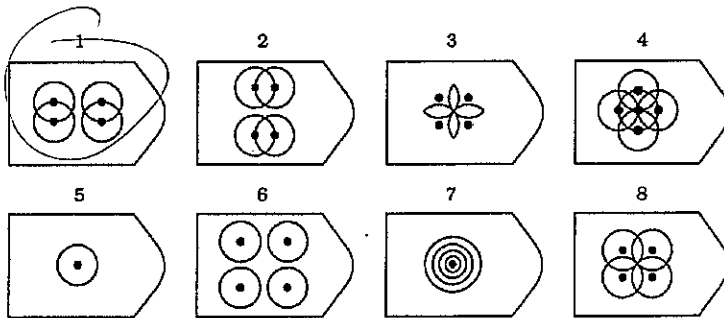
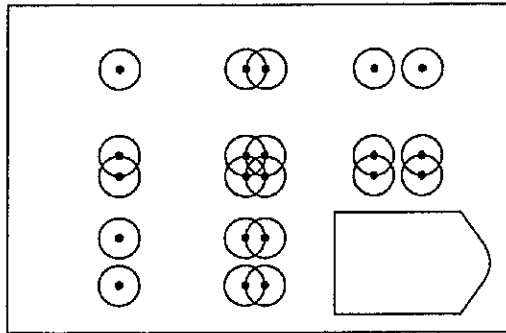


Answer: 4

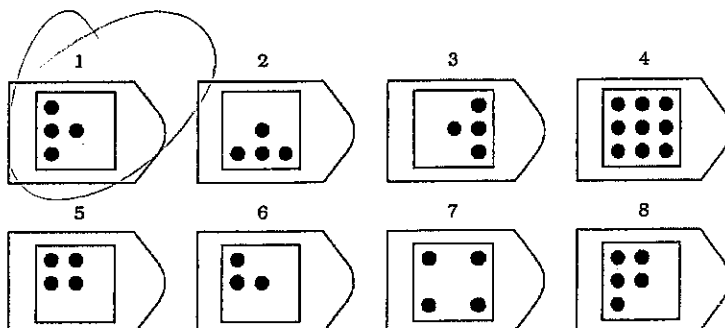
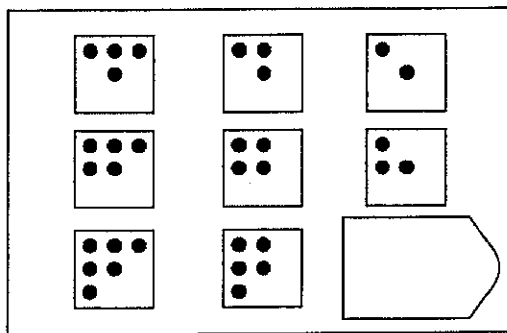
PLEASE CONTINUE ON NEXT PAGE

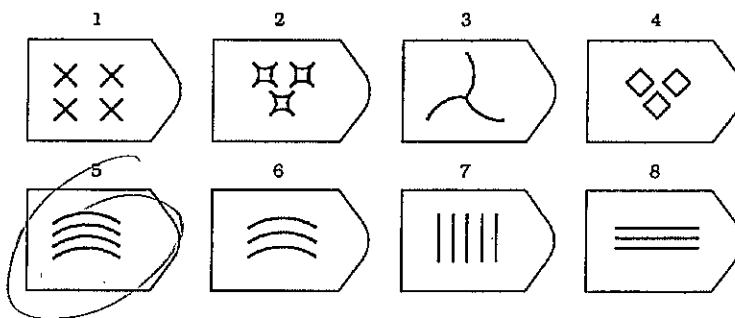
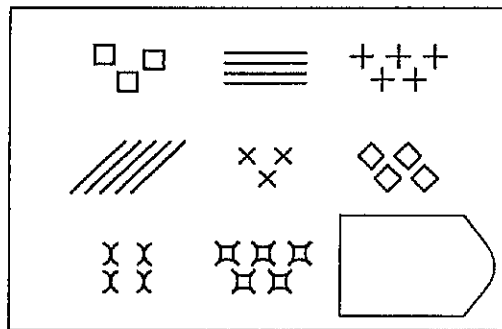
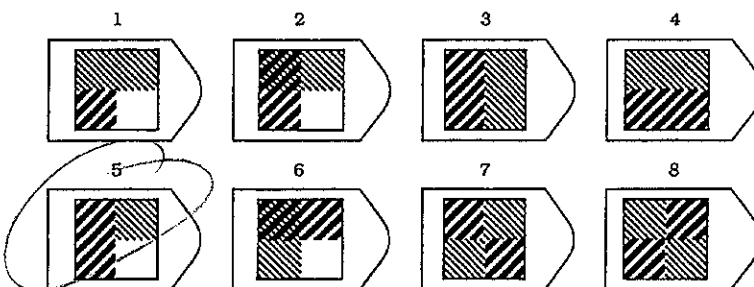
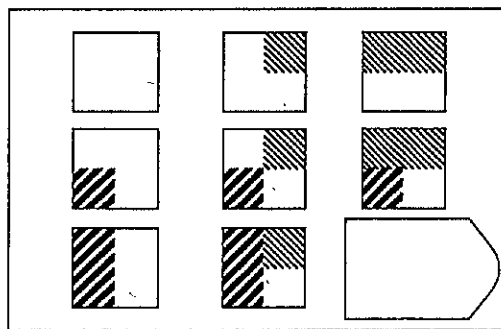
Please choose the image that best completes each of the following patterns.

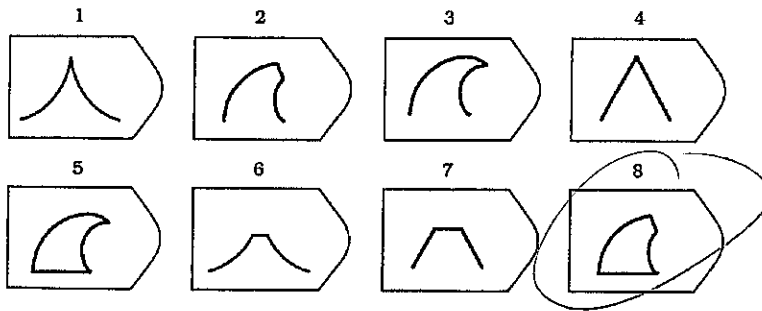
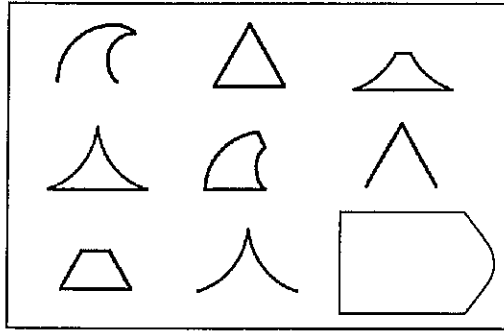
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- B
- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
  - ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
  - C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
  - D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- A
- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
  - B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
  - C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
  - D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

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- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
  - ☒ B. Bob was able to maximize his work time by cutting back on watching TV during the day.
  - C. Sean has been closely monitoring his eating in an attempt to improve his diet.
  - D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- C
- A. After eating a big lunch, Dan went back to his office and took a nap.
  - B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
  - ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
  - D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

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- A. Getting high. They are both involve too much of a chemical influencing the body.
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- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 22 years

What is your home zip code? 48461

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



STUDENT NAME: A40555917  
Version B

GROUP: C5

40

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ An increase in evaporation and cloud formation resulting in the release of latent heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A= erosion, B= deposition, C= uplift and erosion
  - A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - Natural processes are the primary cause of the greenhouse effect.
  - ☒ Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☒ Reservoir A has a shorter residence time than Reservoir B.
  - Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
- $$A = \frac{2}{1} = 2 \quad B = \frac{1}{1} = 1$$
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.

$$\frac{1000}{150}$$

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

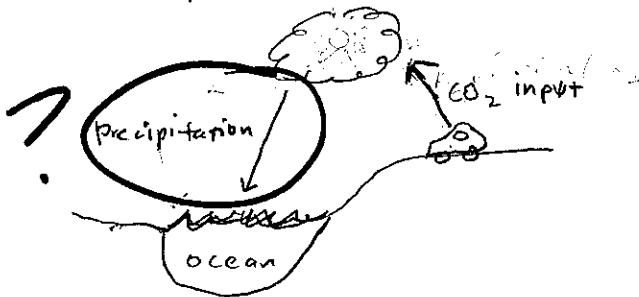
SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

• Ocean acidification is the process of the ocean adding Carbon Dioxide ( $\text{CO}_2$ ) to it and in turn becoming more acidic.



This process is a negative feedback loop because the more  $\text{CO}_2$  we as humans put into the atmosphere, the more  $\text{CO}_2$  that eventually makes it to the ocean causing ocean acidification. So an increase in atmospheric  $\text{CO}_2$  would affect ocean acidification greatly because there would be more  $\text{CO}_2$  in general and therefore more  $\text{CO}_2$  in the oceans. A positive feedback in this situation would be the increase in atmospheric temperature that the increased atmospheric  $\text{CO}_2$  would cause also.

10

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Greenhouse effect is the process by which greenhouse heat is radiated into the atmosphere from the sun but then not allowed back out because of the gaseous layer which is formed by greenhouse gases such as  $\text{CO}_2$ , methane, water vapor, etc. Volcanism affects greenhouse effect because when they erupt, they emit mass amounts of  $\text{CO}_2$  and ash into the atmosphere. So if volcanism on Earth suddenly increased dramatically, so would the amount of  $\text{CO}_2$  and ash in the atmosphere which would affect Earth's atmosphere. So as the  $\text{CO}_2$  increased, so would the greenhouse effect which would warm the Earth. But on the other hand, the ash would block some of the sun's heat entering the earth, which would decrease the atmospheric temperature. So the effects of the increased volcanism wouldn't be seen until the ash in the atmosphere settled, causing the  $\text{CO}_2$  to be a more predominant factor in the increase of temperature.

5

01

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is the process of liquid changing into a gas. And degassing is the process of a material getting rid of its gas. So they are similar in that they both get rid of gas + different because one is from a liquid + one is from a solid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

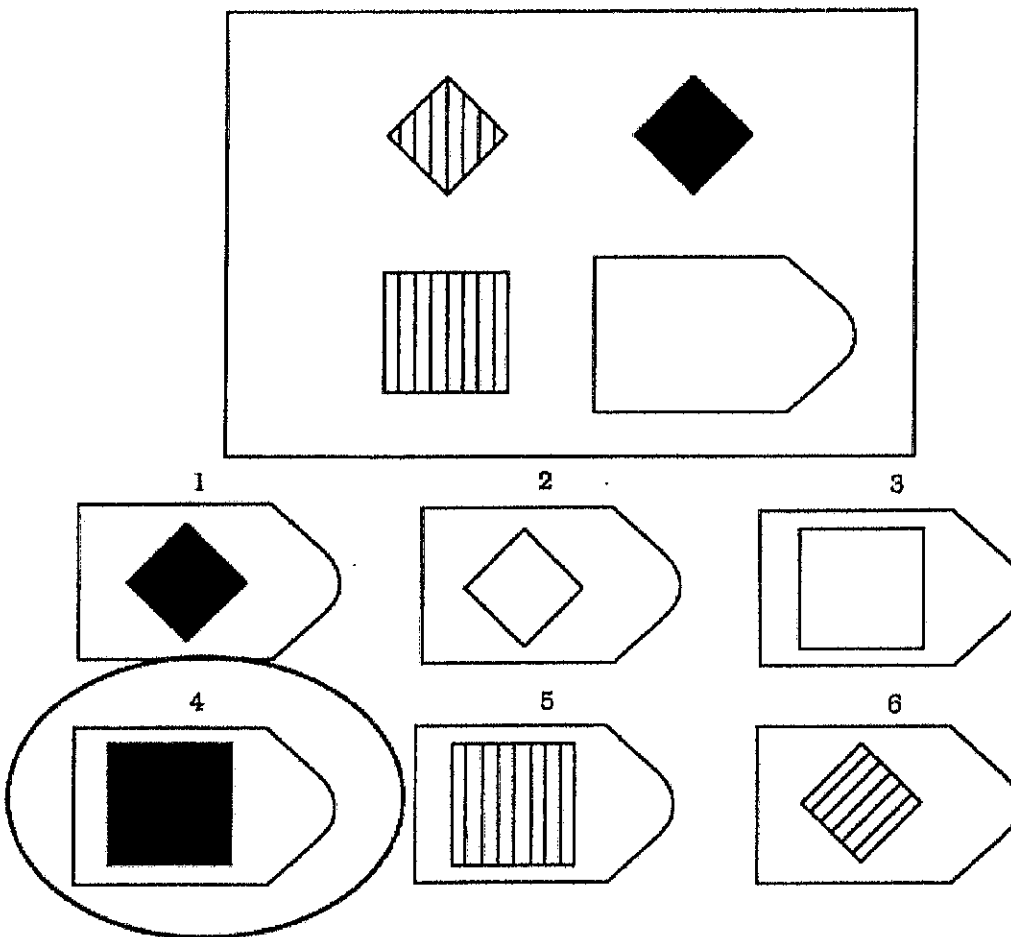


# Analogical Assessment

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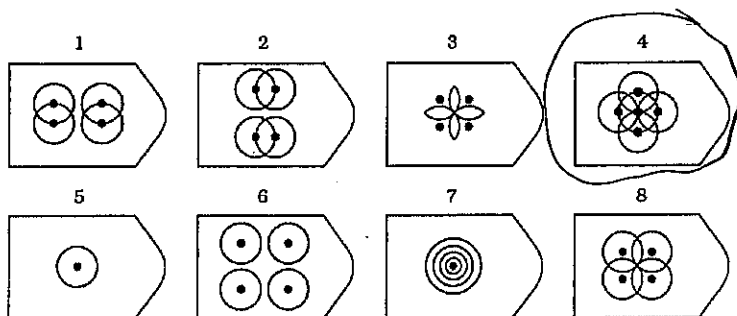
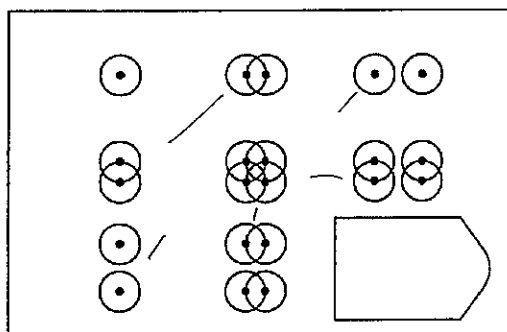


**Answer: 4**

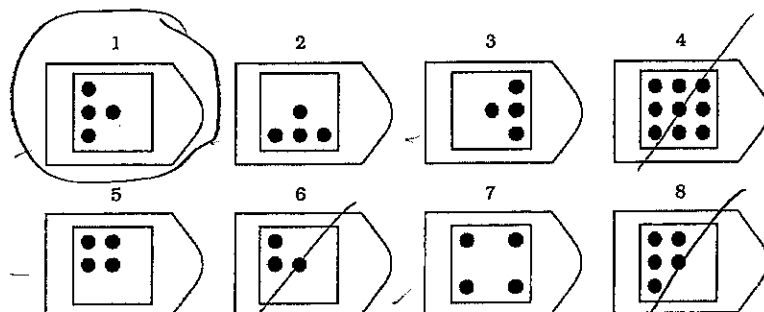
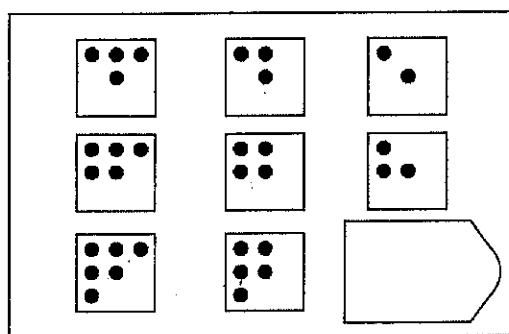
PLEASE CONTINUE ON NEXT PAGE

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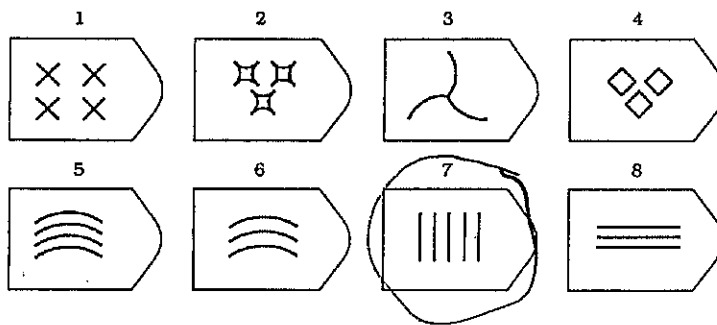
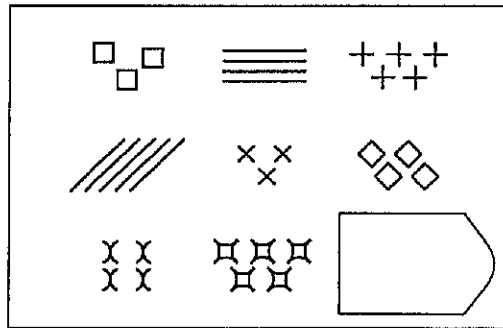
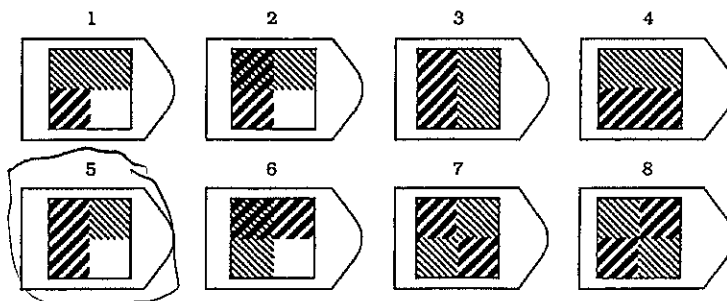
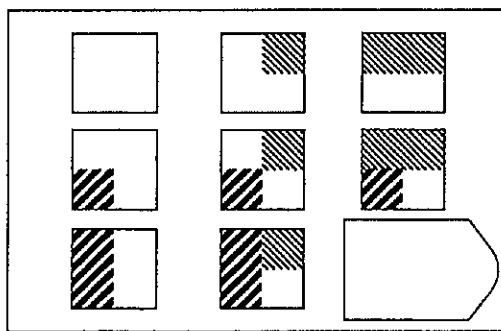


### PATTERN 2

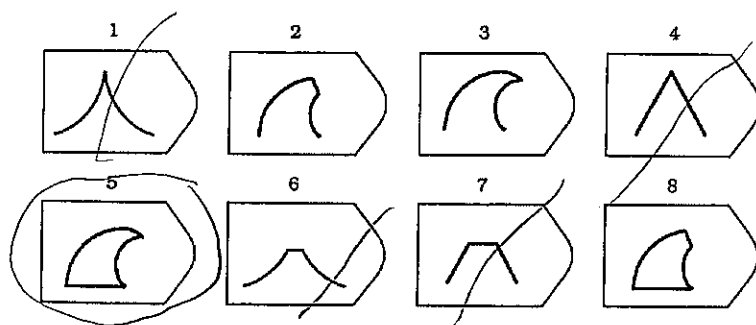
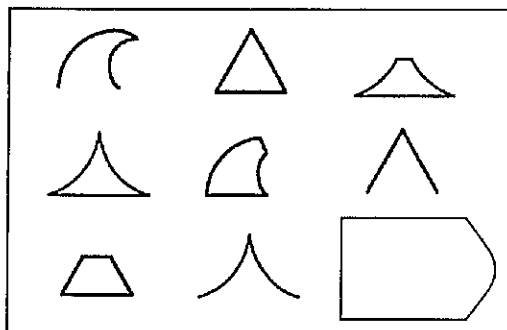


PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

## PATTERN 5



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*Example*

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☐ B. Bob was able to maximize his work time by cutting back on watching TV during the day.

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☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

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PLEASE CONTINUE ON NEXT PAGE

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- 

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- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
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## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48374

What is your gender?

- ☐ Male
- ☐ Female
- ☒ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 42115313  
Version B

GROUP: C5

40

+ → increasing

- → eventual equil

MULTIPLE-CHOICE. 5 points each (50 points total).

- C 1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
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  - ☒ b. Gas bubbles forming in the magma
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  - ~~d. Crystals forming in the magma~~
- C 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion
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- Human activities are the primary cause of the greenhouse effect.
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- B 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A. B =
  - Reservoir A and Reservoir B have equal residence times. A =
  - More information about Reservoir A and Reservoir B is needed.
- B 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.



$$RT = \frac{\text{amount}}{\text{flux}}$$

- D 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

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- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

- B 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
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SHORT ANSWER. 25 points each (50 points total)

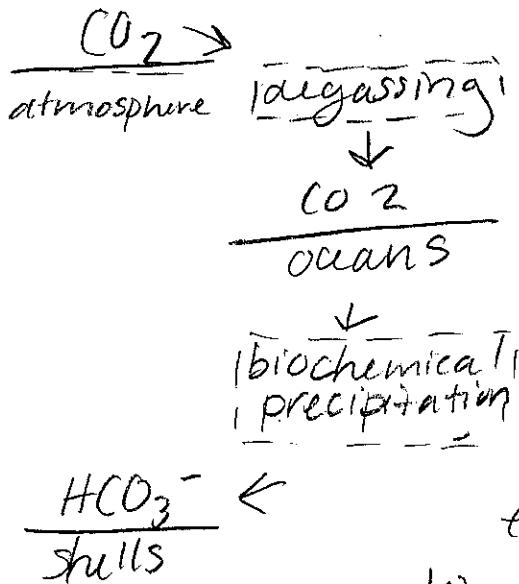
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

10

An increase in atmospheric  $\text{CO}_2$  will cause the temperature in the atmosphere to increase as well due to the extra presence of GHG. The atmosphere's increase in temperature will cause it to release gases faster due to the higher temp & eventually transport the  $\text{CO}_2$  to the oceans where it will go through the process of \_\_\_\_\_



& become present in marine skeletons or shells. The initial increase in atmospheric  $\text{CO}_2$  eventually loops through the cycles & becomes deposited in sea shells leaving the  $\text{CO}_2$  to remain in the reservoir for a good amount of time. The long cycle of

Carbon dioxide is an example of a negative feedback loop because it eventually returns to equilibrium while the increase of  $\text{CO}_2$  in the atmosphere will cause a positive feedback loop in the water cycle due to increased GHG & temp.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect
- Clear connections between events and changes in atmospheric temperature.

If volcanism were to suddenly increase dramatically, then an equally sudden, even more dramatic increase in atmospheric temperature would result. This is due to the effects of greenhouse gases. When volcanoes erupt, they emit giant ash clouds containing large amounts of carbon dioxide, a greenhouse gas. This gas stays in the atmosphere reservoir for a long RT time and is joined by even more  $\text{CO}_2$  as a result of the ash cloud letting less solar radiation through to the earth's surface, trapping it in the atmosphere increasing temperatures even more.

5

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

both are a form of transportation  
but one is thermal & one is chemical



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

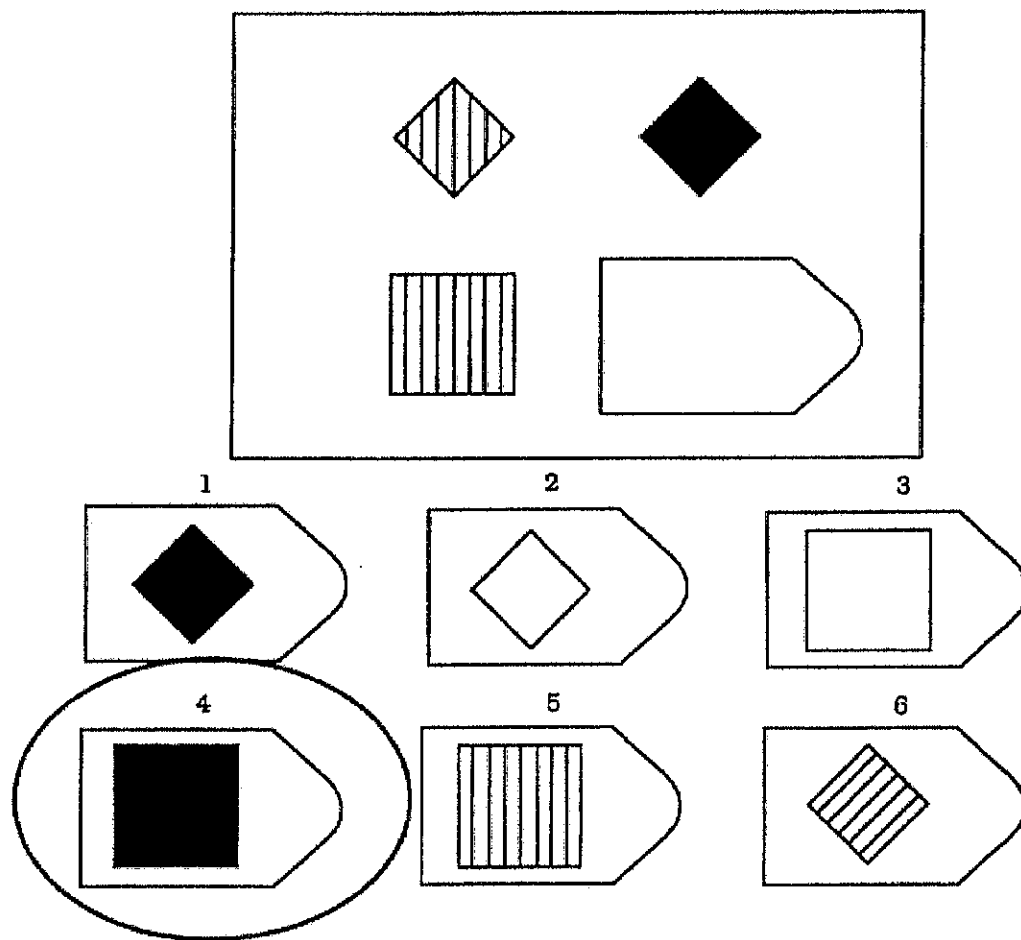
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

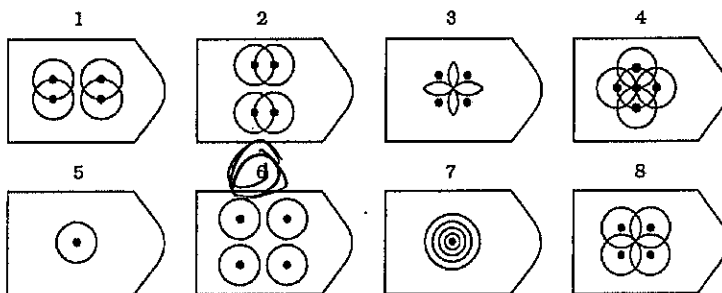
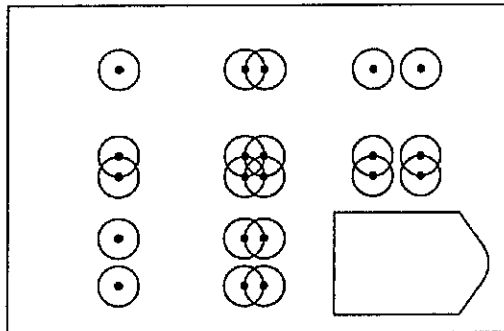


**Answer: 4**

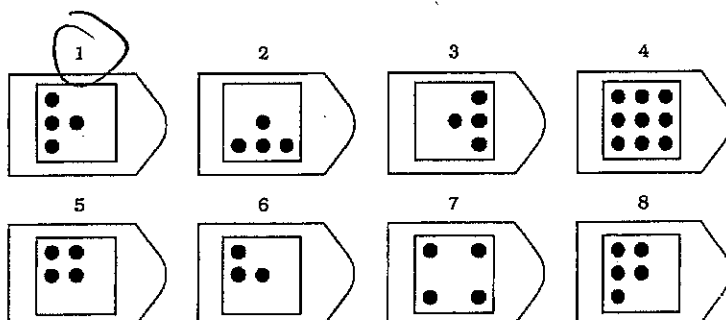
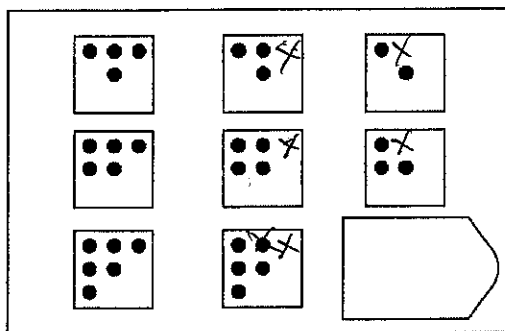
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Please choose the image that best completes each of the following patterns.

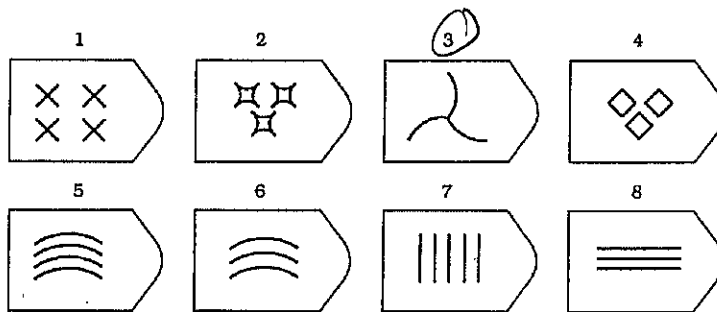
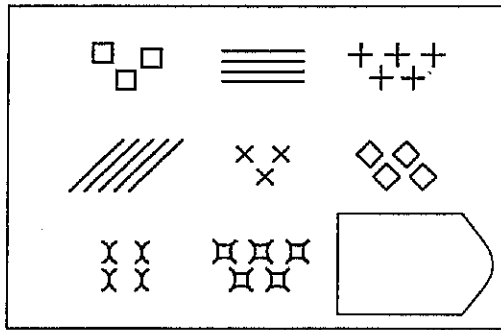
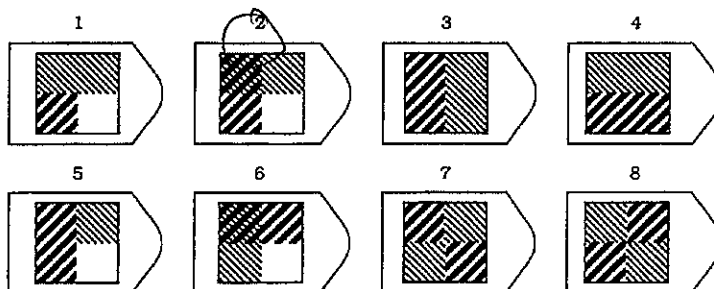
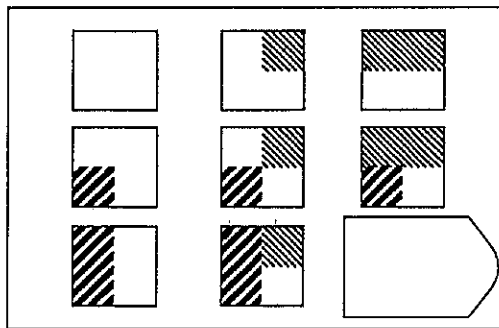
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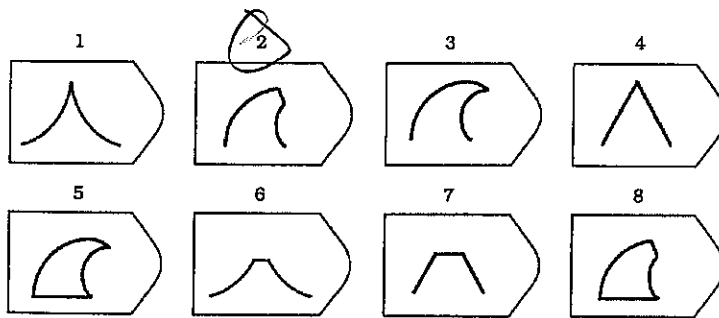
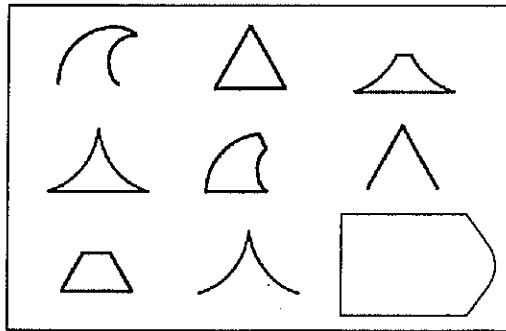


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.

☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.

C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.

D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

---

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

A. Getting high. They are both involve too much of a chemical influencing the body.

B. Hitting your head. They both involve something that causes headaches.

☒ C. Being sleep deprived. They both involve impaired functions.

D. Eating too much candy. They both involve lack of self-control.

E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

A. Dew forming. They are similar because they both involve a drop in temperature.

☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.

C. Clouds forming. They are similar because they both involve a phase change.

D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48393

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other



STUDENT NAME: 4 22050  
Version AGROUP: C6

## MULTIPLE-CHOICE. 5 points each (50 points total).

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface? 36
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then C limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time? (=)
- ☒ a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- ☒ d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- ☒ a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Atmospheric carbon dioxide would raise the levels of  $\text{CO}_2$  in the ocean, raising the pH levels and causing it to become more acidic. The ocean and atmosphere are set at a equilibrium, so when one raises or lowers the other does also. Carbon dioxide plus water cause a breakage in the bonds releasing energy and raising the ocean's acidification.

Negative feedback in ocean acidification is like when too much marine life dies and decomposes it raises the  $\text{CO}_2$  in the ocean but if it is too cold outside the atmospheric acidification will not rise.

Positive feedback in the process of acidification is when the  $\text{CO}_2$  in the atmosphere is lowered like  $\text{CO}_2$  in the ocean, they both are working together and producing the same outcome.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The temperature would actually confuse itself.  
? It would rise from the ash and heat of the volcano  
• but would remain constant because the ash will block the sun's solar radiation from emitting heat upon the earth. The greenhouse effect will cause the levels of  $CO_2$  to rise but  
? the sun won't be able to play as big of a role in it that it can.  
For example Hawaii being a cool place although it is made up of volcanic rock island the  $CO_2$  is higher but the ash is being the evil middle man.

1

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are similar because it is the release and movement of (something) and photosynthesis.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

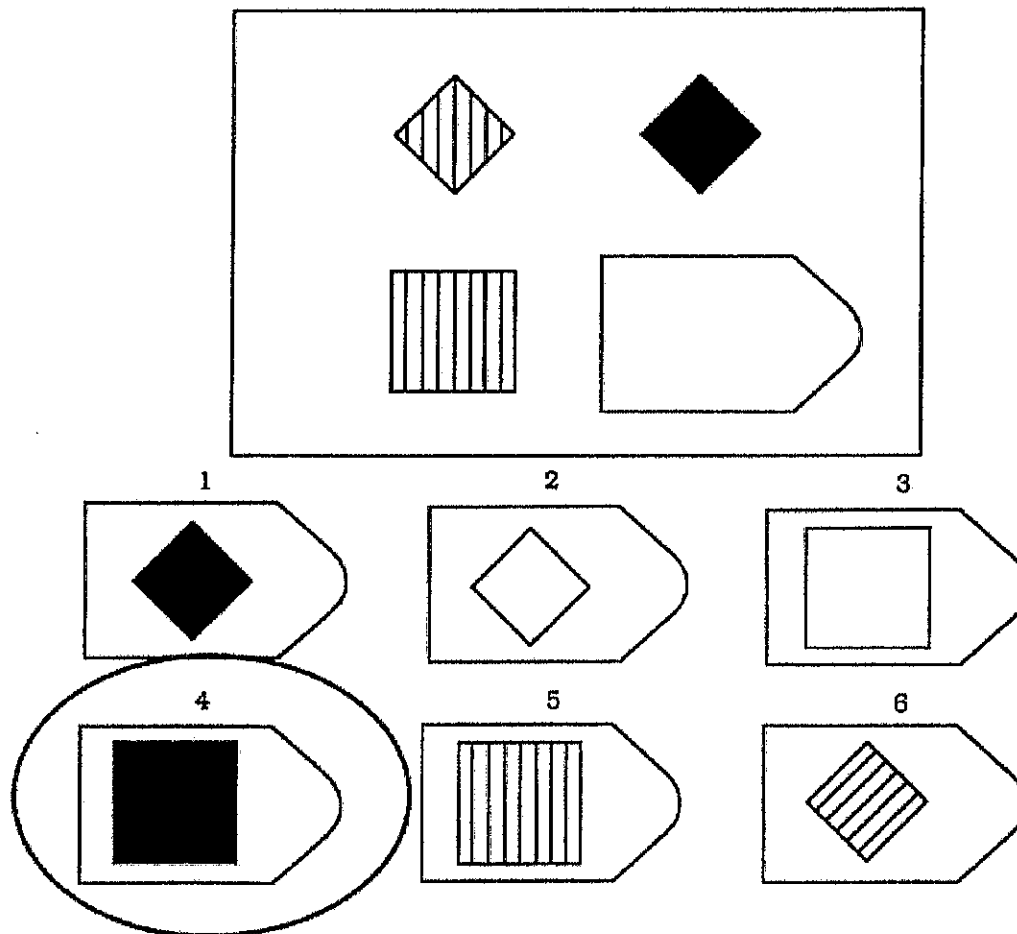
**Thoughtfully complete the attached survey**



# Analogical Assessment

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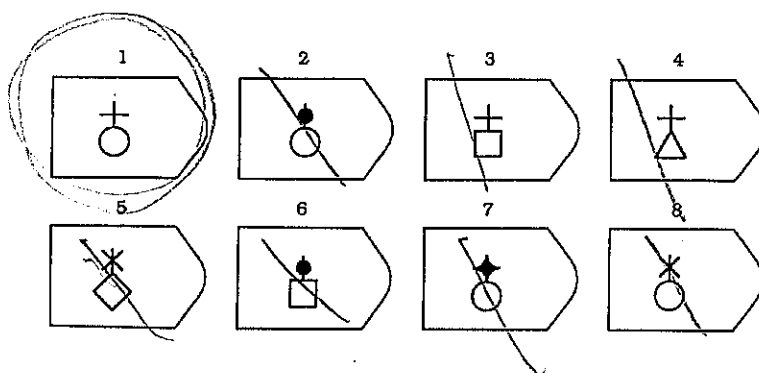
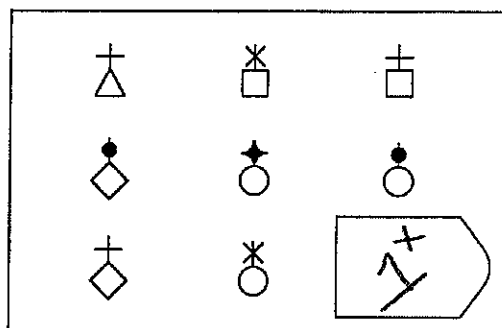


**Answer: 4**

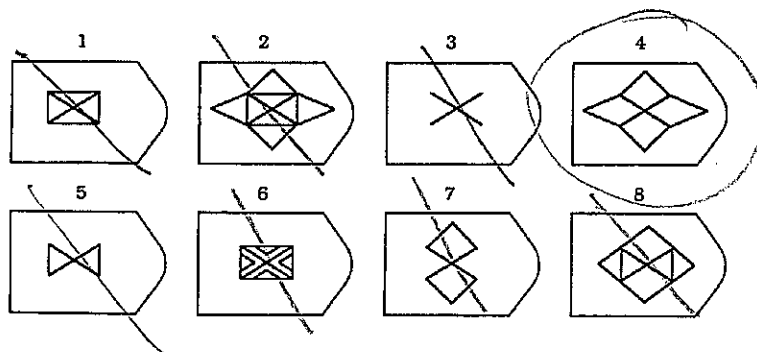
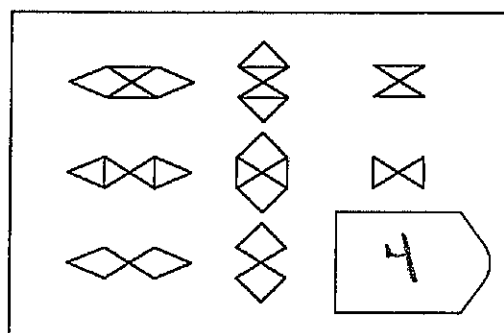
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### PATTERN 1

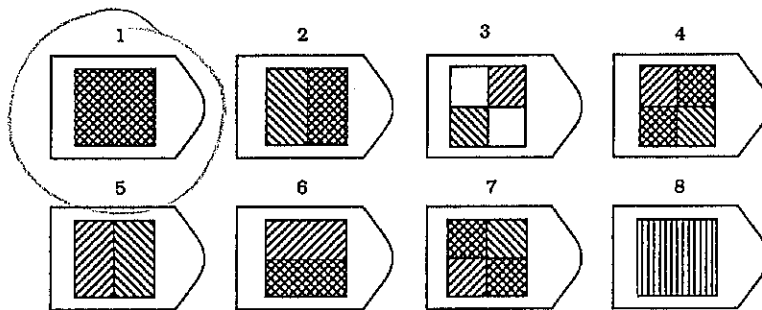
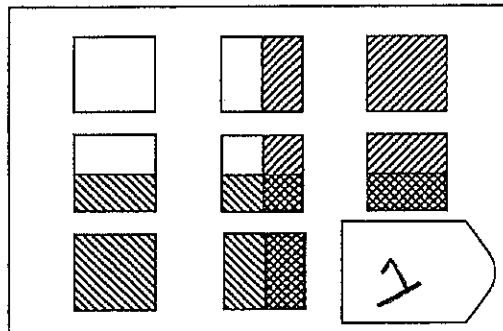
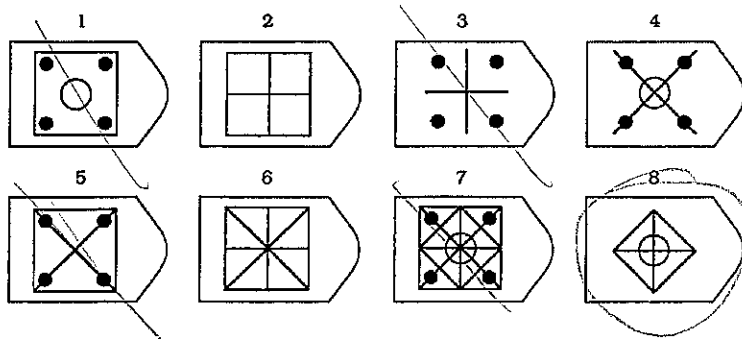
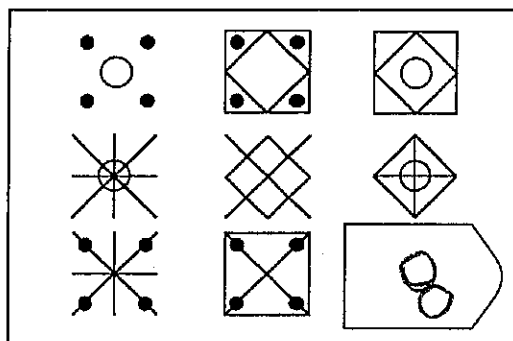


### PATTERN 2

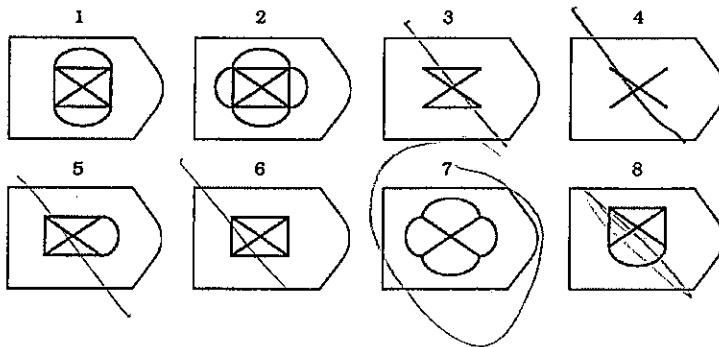
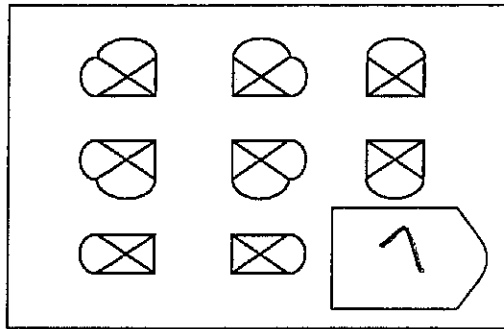


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**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ☒ A. The plumber fixed the pump that had burst and flooded the basement.
- ☐ B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
- ☐ C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
- ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- ☐ B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- ☐ C. Blowing bubbles. They are similar because they both float until they eventually pop.
- ☐ D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- ☐ A. Getting the flu. They are similar because they are both caused by viruses.
- ☐ B. Getting pink eye. They are similar because they are both contagious.
- ☐ C. Getting the flu. They are similar because they are both caused by not washing your hands.
- ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
- ☐ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 49009

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☒ African American/Black

☐ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

STUDENT NAME: A 42600065  
Version A

GROUP: C6

70

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
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  - d. Crystals forming in the magma
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- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
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- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
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6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- ☐ a. The reservoir will eventually disappear.
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  - ☐ c. The reservoir is growing smaller.
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8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
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10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☐ a. The Earth's atmosphere would become colder than it is today.
  - ☐ b. The Earth's atmosphere would become warmer than it is today.
  - ☒ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

4 A) Ocean acidification occurs when the water is cooler, this is because when the water is cooler it absorbs more gases such as  $\text{CO}_2$  easier than when it is warmer. The cooler the water the more  $\text{H}^+$  ions will be absorbed because atoms in the water are moving slower when cooler and are more compacted together, this means the water would trap  $\text{H}^+$  ions easier which in result we have lowered  $\text{H}^+$  ions make water more acidic

B) An increase in atmospheric carbon dioxide would mean an increase in atmospheric temp. Increase in atmospheric temp means increase in ocean temp, increase in ocean temp would make ocean water less acidic because warmer the water the less absorbed. The example of positive feedback in this is that when there is an increase in carbon dioxide there is also a further increase in the temp of the atmosphere + the ocean. The example of negative feedback is the counter reaction in the increase in temp of the ocean making it less acidic than more acidic (less  $\text{pH}$ ) even though the atmosphere is

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- a. An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.  
b. Clear connections between events and changes in atmospheric temperature.

25  
a) Processes that relate to volcanism would be the movement of Plate tectonics more specifically ocean-ocean convergent, also buoyancy effects the rate at which volcanoes would erupt, the warmer the magma is as it rises and the slower it cools would make for an eruption again this is due to buoyancy. An explanation of the greenhouse effect would be the amt of suns radiation that is absorbed and reflected by the earth. Sun's rays hit @ short wavelength and are unaffected by molecules in atmos when hitting earth's surface. Once they hit they are either absorbed or reflected back into space. If absorbed they are used as infrared energy which is then re-emitted back into atmos and absorbed by  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  and methane or again reflected back into space, the amt of  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  and methane absorbed by infrared is what causes greenhouse effect.

b) Increase in volcanism and formations of ash clouds would change atmospheric temp because at first volcanic eruptions would be thought to warm atmos temp because of the gases released during eruptions, however ash clouds would block the sun's solar radiation from directly hitting the earth's surface. In conclusion no infrared energy would be absorbed, what infrared energy absorbed the earth's atmos would ultimately cool the

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

degassing occurs when there is less pressure meaning warmer same w/ evaporation occurs when water is warmer and evaporates into atmos

ultimately cool the atmos + make oceans more acidic



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

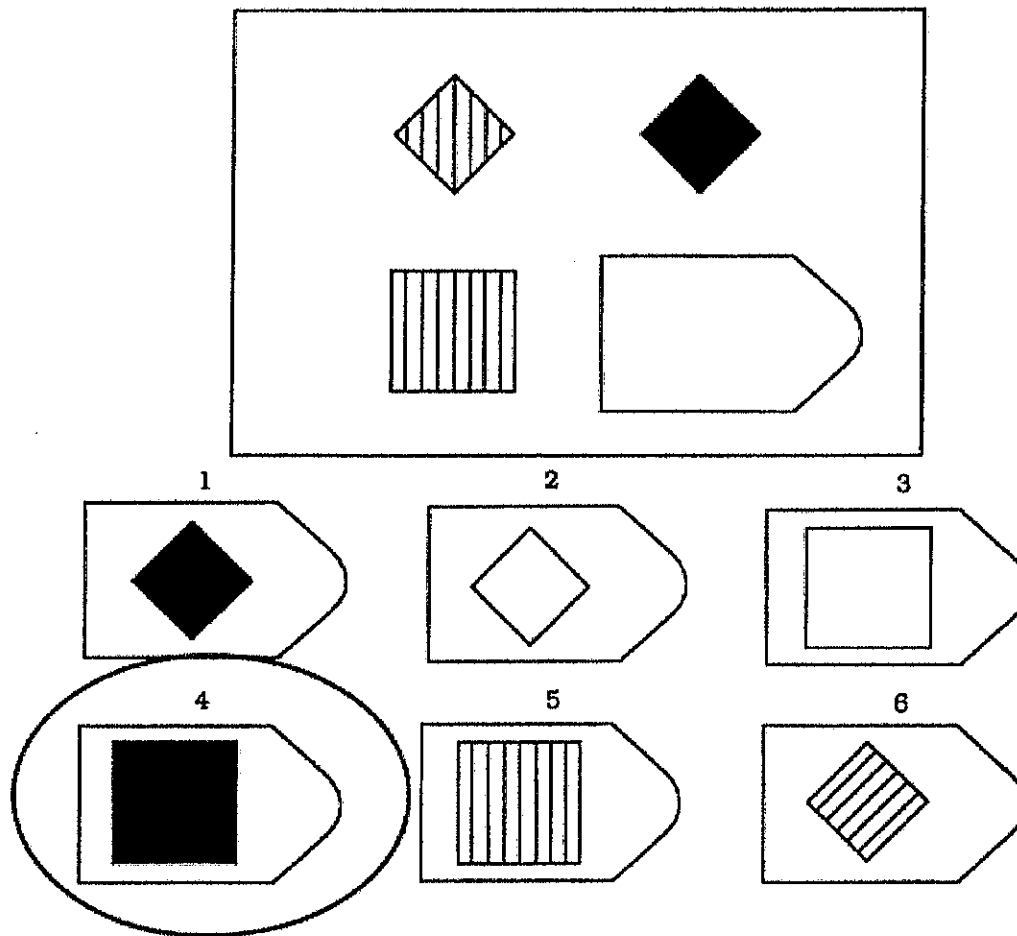
**Thoughtfully complete the attached survey**



# Analogical Assessment

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*Example*

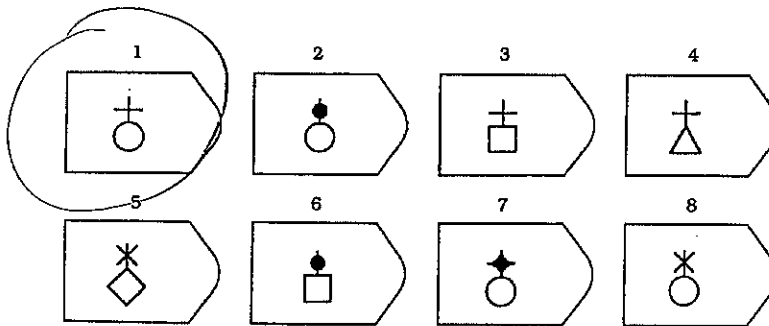
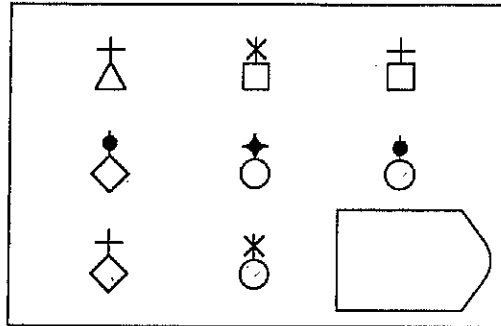


**Answer: 4**

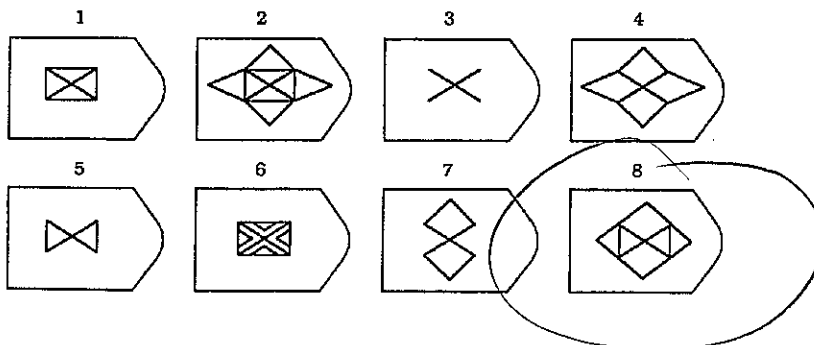
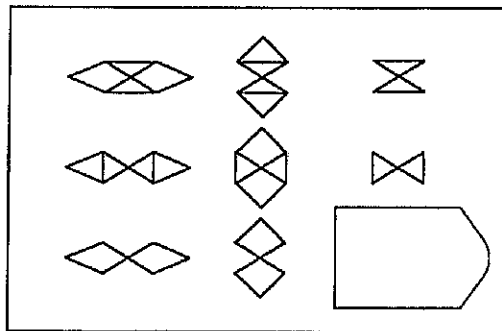
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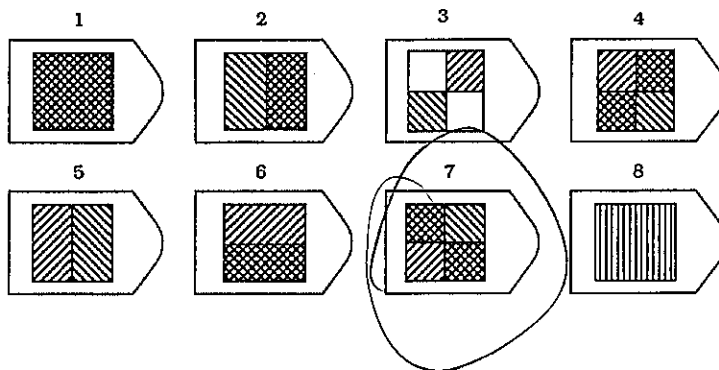
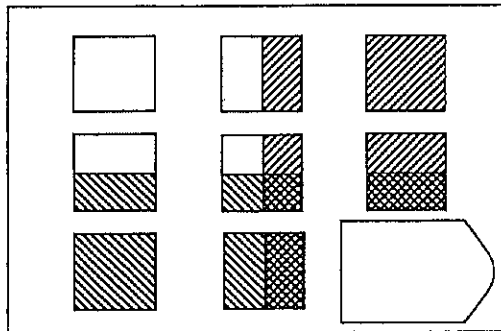
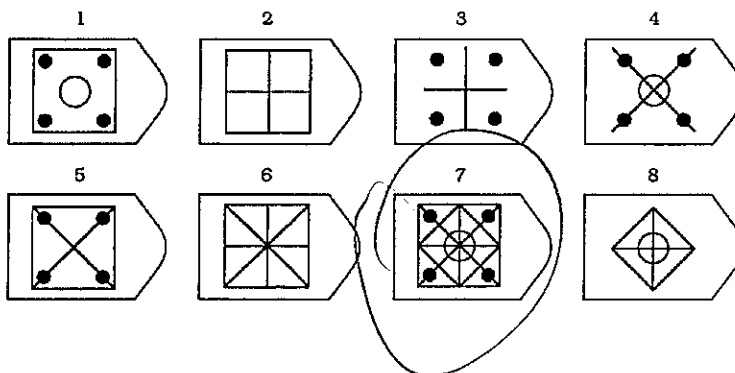
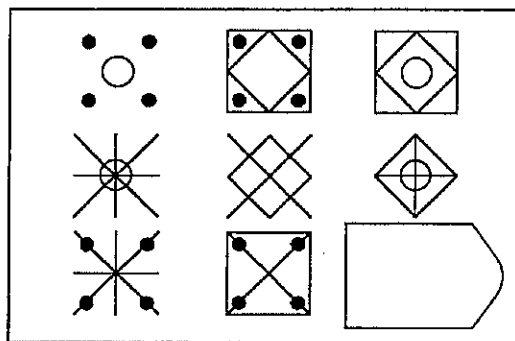
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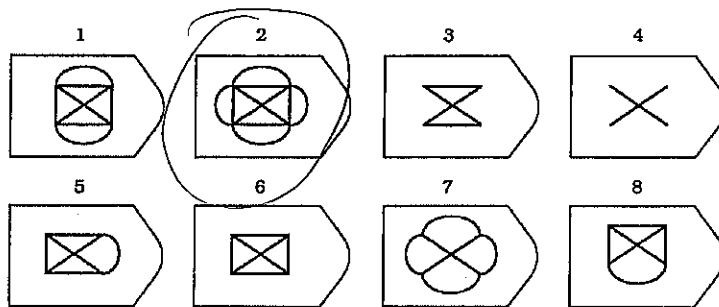
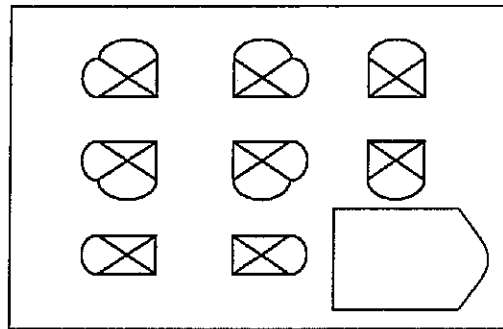
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

**Please choose the best analogy to each of the following statements.**

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  - B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
  - C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
  - D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.
  
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  - C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
  - D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

*PLEASE CONTINUE ON NEXT PAGE*

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- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

**Please choose the response that is closest to an analogy that you might make.**

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  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? \_\_\_\_\_ years

What is your home zip code? \_\_\_\_\_

What is your gender?

- ☐ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



STUDENT NAME: A43763919  
Version A

GROUP: C6

40

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- ☒ a. The magma becoming colder  
☐ b. Gas bubbles forming in the magma  
☐ c. The surrounding crust becoming hotter  
☐ d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- ☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere  
☐ c. An increase in evaporation and cloud formation resulting in the release of latent heat  
☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- ☐ a. A= erosion, B= deposition, C= uplift and erosion  
☐ b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
☐ d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- ☐ a. Human activities are the primary cause of the greenhouse effect.  
☐ b. Natural processes are the primary cause of the greenhouse effect.  
☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
☐ e. The human and natural causes of the greenhouse effect are not understood.

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- ☐ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- ☐ a. Reservoir A has a shorter residence time than Reservoir B.  
☐ b. Reservoir B has a shorter residence time than Reservoir A.  
☒ c. Reservoir A and Reservoir B have equal residence times.  
☐ d. More information about Reservoir A and Reservoir B is needed.

equal to each other  
& both have the same  
influx & outflow

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

3 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.

X 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

p 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- C a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

D 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase of  $\text{CO}_2$  in the atmosphere would cause ocean acidification to increase as well. With more  $\text{CO}_2$  in the air, this causes the sun's IR rays to be more easily trapped which heats up the earth. With the temperature rising, this causes more  $\text{H}_2\text{O}$  to evaporate from the ocean, allowing more room for  $\text{CO}_2$  molecules to be absorbed in the ocean, thus increasing the acidification. In order to restore itself back to equilibrium, if there is more  $\text{CO}_2$  in the atmosphere, some of that  $\text{CO}_2$  moves into the ocean so it will be balanced.

The process of an increased  $\text{CO}_2$  level in the atmosphere, trapping more of the Sun's IR rays through the Greenhouse Effect is a negative feedback because it does not put even more  $\text{CO}_2$  in the air. Instead it moves from the air to the ocean.

The positive feedback during ocean acidification occurs when

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The process of the greenhouse effect begins with the Sun. The Sun's rays heat the earth because as the visible IR rays come towards the earth, some are absorbed into the ground while others are reflected. These reflected rays of heat are partially trapped in the molecules of the earth's atmosphere & other rays escape & go back into space. The more matter & molecules that there are in the earth's atmosphere, the more Sun rays would be caught & the warmer the earth would become.

15 But if there is an increase in volcanic activity & they erupt large ash clouds, this puts more molecules in the atmosphere which will block & won't hold in those sun rays that are reflecting off of the earth & bouncing back towards space. The ash will act almost as a barrier, just as normal clouds do & that will prohibit the sun rays from heating up the earth.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

X Evaporation & degassing both are processes that change matter into a different state. Evaporation = becoming gaseous  
Degassing = removing gas

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

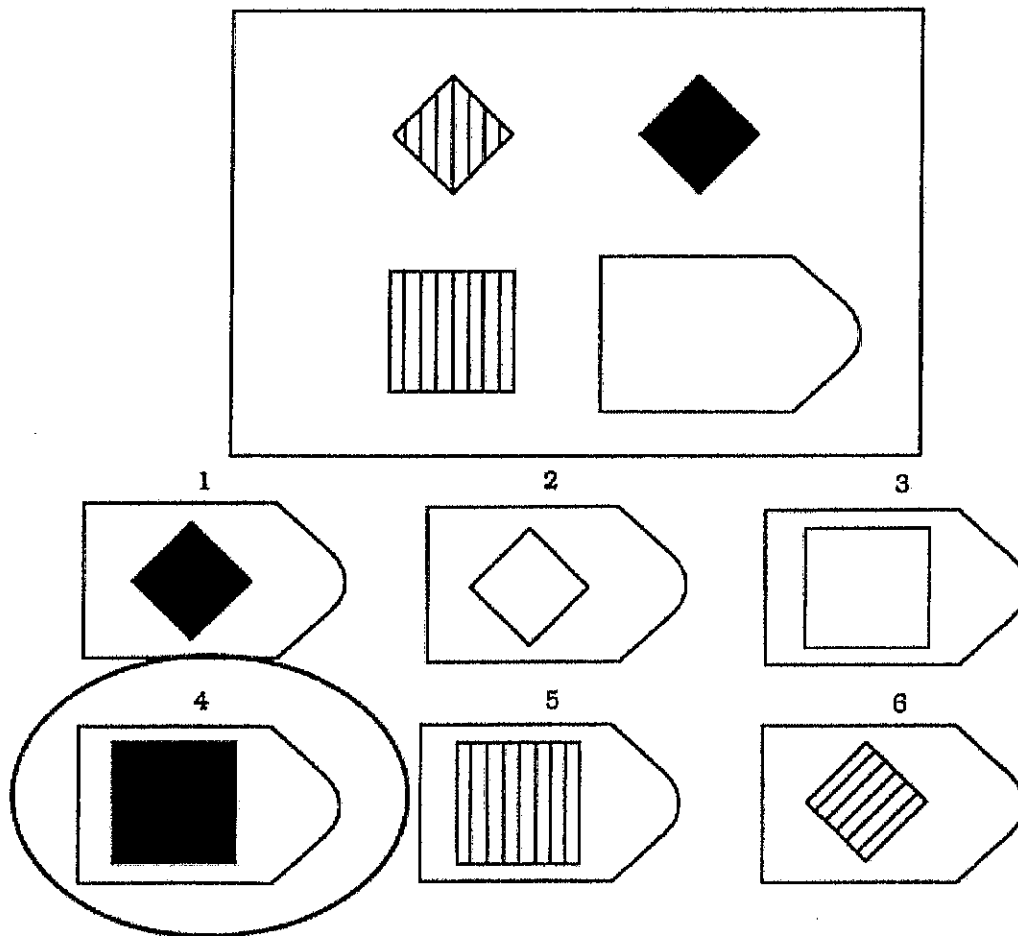
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# Analogical Assessment

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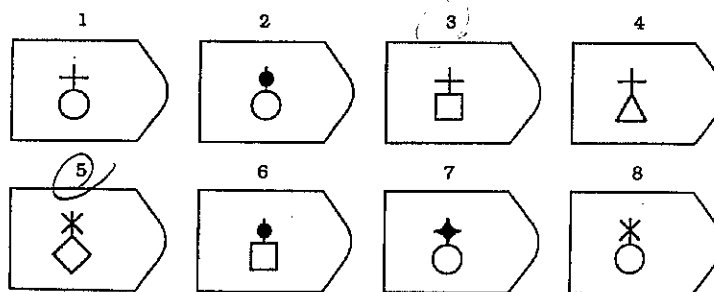
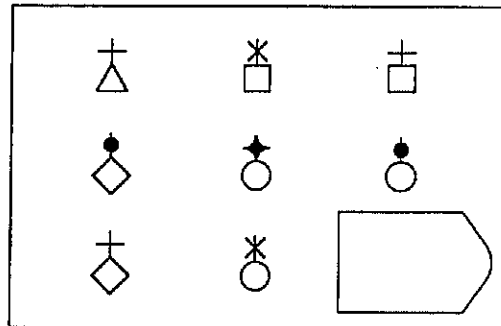


**Answer: 4**

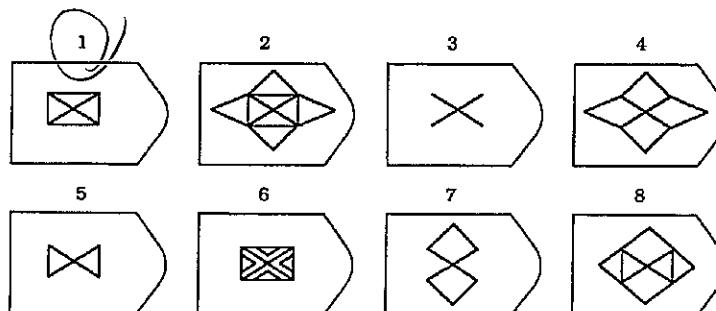
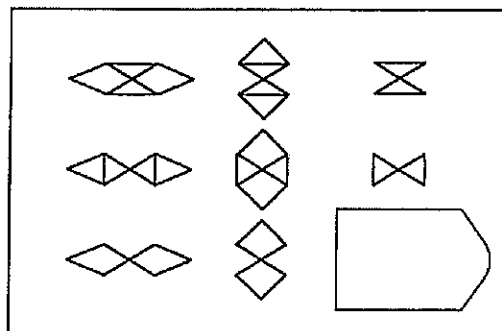
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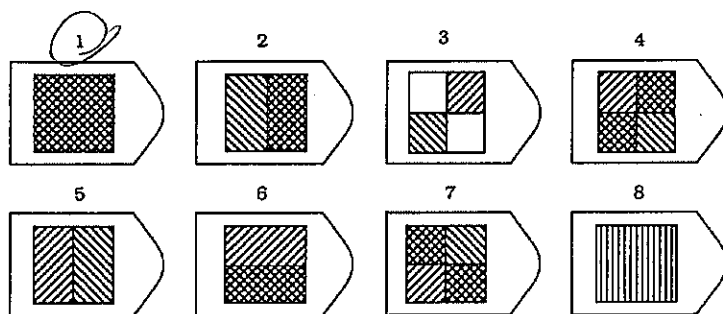
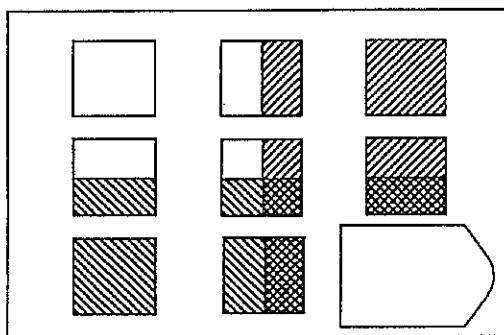
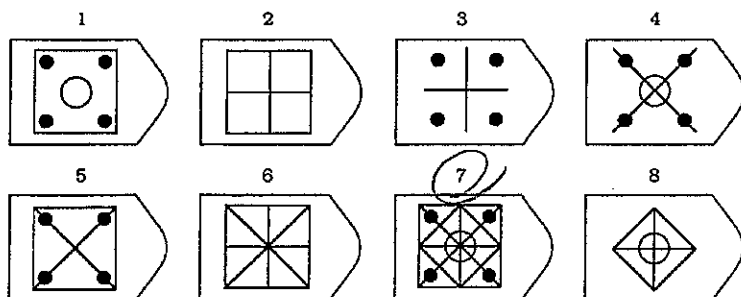
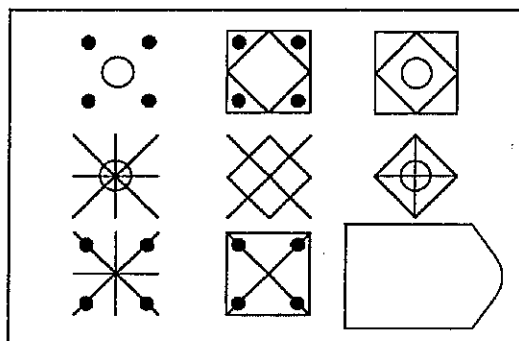


### PATTERN 2

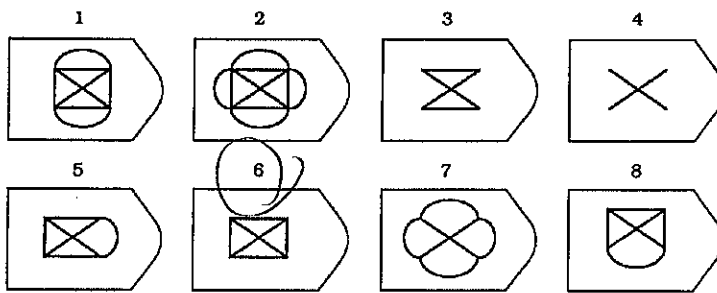
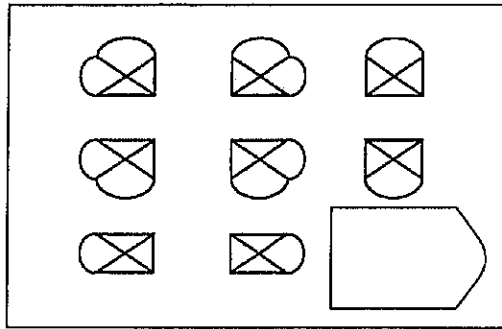


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**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

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PLEASE CONTINUE ON NEXT PAGE

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  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 49251

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A39966164  
Version A

GROUP C6

67

**MULTIPLE-CHOICE. 5 points each (50 points total).**

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☐ a. The magma becoming colder  
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☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
☐ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
☐ a. Reservoir A has a shorter residence time than Reservoir B.  
☒ b. Reservoir B has a shorter residence time than Reservoir A.  
☐ c. Reservoir A and Reservoir B have equal residence times.  
☐ d. More information about Reservoir A and Reservoir B is needed.

~~A = 2x B~~      ~~B = B~~  
~~A = 1000 / 100 = 10~~      ~~B = 500 / 100 = 5~~

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ☐ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - ☐ b. The Earth's atmosphere would become warmer than it is today.
  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

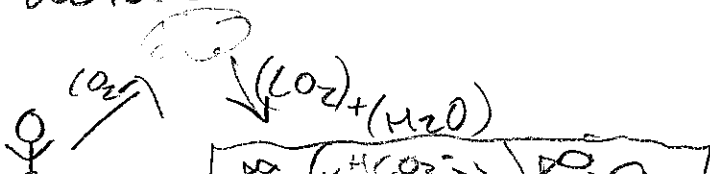
- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

20

A. As the amount of  $\text{CO}_2$  (gas) in the atmosphere increases more  $\text{CO}_2$  comes in contact with the  $\text{H}_2\text{O}$  in the oceans. The chemical reaction  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$  is then able to occur more and more, as more  $\text{CO}_2$  comes in contact with  $\text{H}_2\text{O}$ . Combining the gas with the water molecule produces an acid ( $\text{HCO}_3^-$ ) and an extra Hydrogen atom ( $\text{H}^+$ ). The acid mixes with the ocean water = Ocean Acidification.  $\checkmark$

3. Negative Feedback Loop = As the oceans take on more and more  $\text{CO}_2$  in the form of  $\text{HCO}_3^-$ , the less there is in the atmosphere. This leads to less  $\text{CO}_2 + \text{H}_2\text{O}$  reactions = less acid produced = less ocean acidification.

Positive Feedback Loop = If the increased  $\text{CO}_2$  in the atmosphere was consistently growing from the human race's greenhouse gas output, the cycle would continue to turn our oceans more acidic.



5

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

2. When an erupting volcano throws ash into the atmosphere, the particles of ash block solar radiation. The greenhouse effect is where molecules like  $H_2O$  and  $CO_2$  in the atmosphere trap heat from the sun. This warms the earth's atmosphere and thusly, the surface. When dust or ash in the atmosphere come in contact with solar radiation, they reflect most of it away from Earth. This causes the atmosphere to cool and thusly, the earth's surface as well.

3. If volcanic activity increased on our planet, the large ash clouds formed from volcanic eruptions would act much like water clouds do. I.e. they would reflect the Sun's solar radiation back into space, cooling the atmospheric temperature of Earth.

10

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different? Evaporation is the process of turning a liquid to a gas. Degassing is the process by which gas is removed from a solution.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

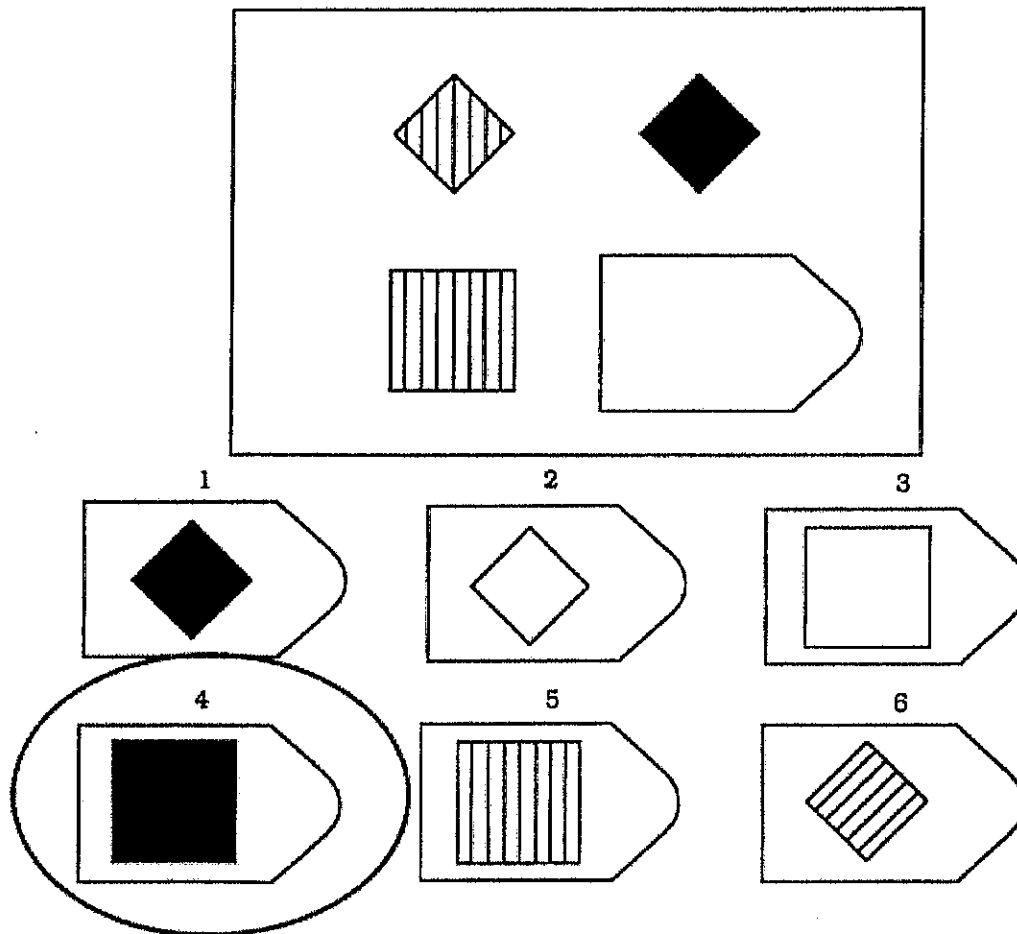
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

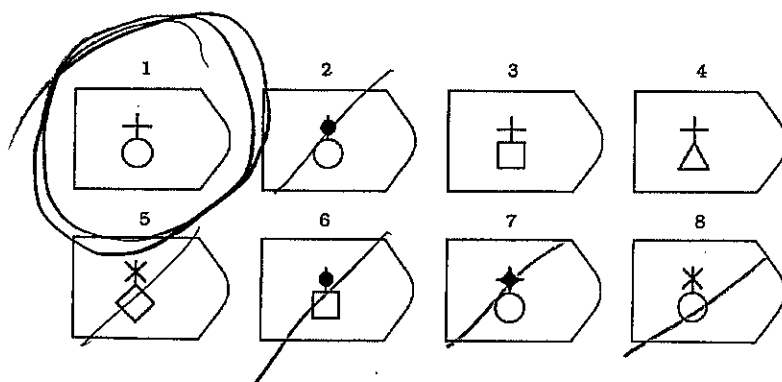
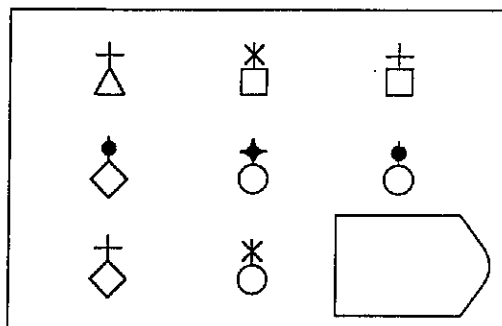


**Answer: 4**

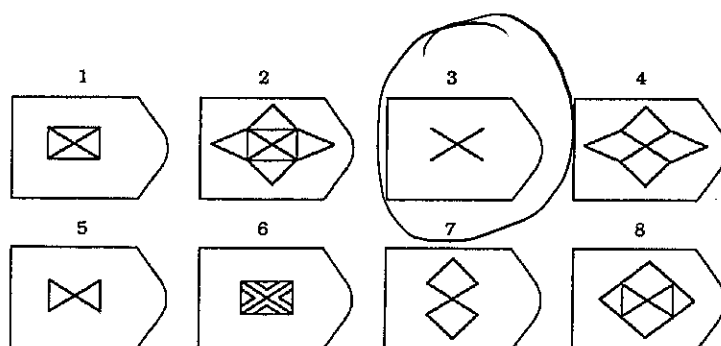
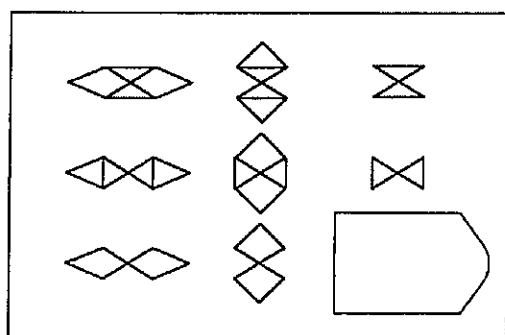
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Please choose the image that best completes each of the following patterns.

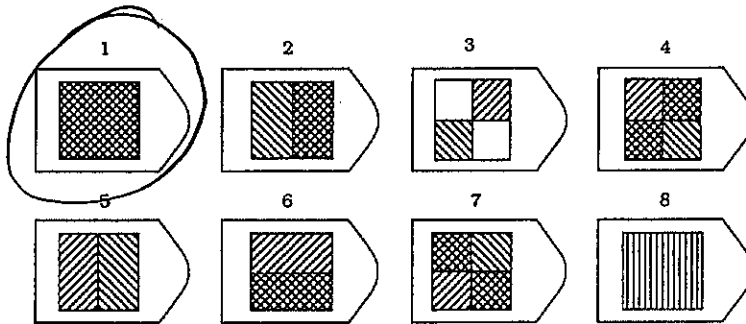
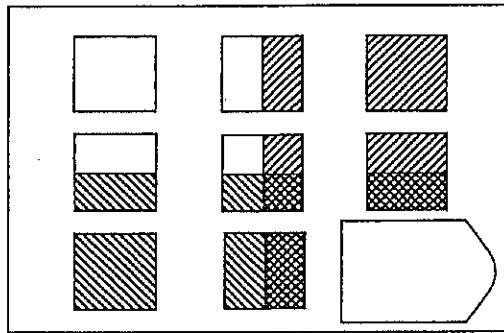
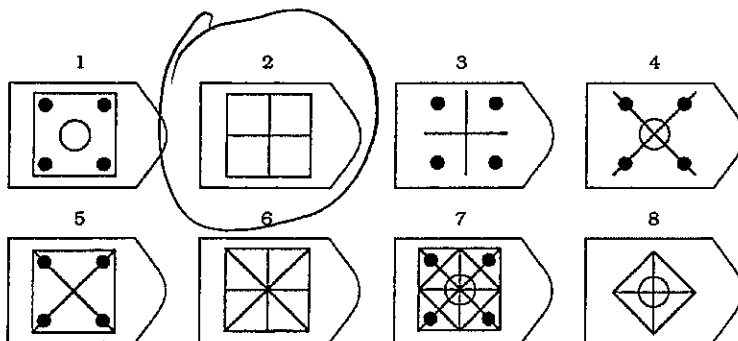
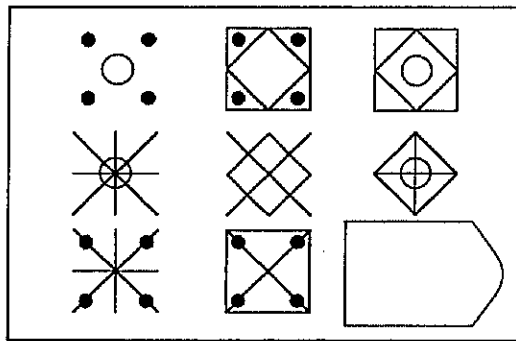
### PATTERN 1



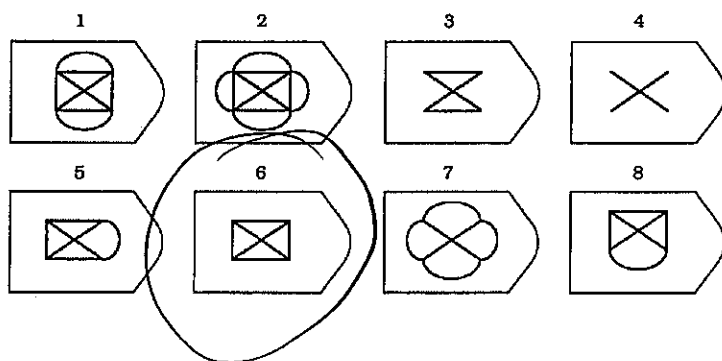
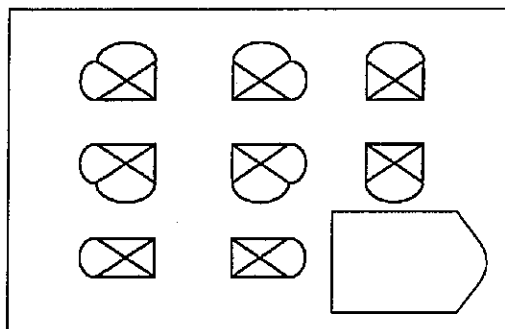
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- ☒ A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- ☐ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- ☐ D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- ☒ A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- ☐ B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- ☒ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☐ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- ☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- ☐ C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- ☐ D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- ☒ A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- ☐ B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- ☐ D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ☐ A. The plumber fixed the pump that had burst and flooded the basement.
  - ☐ B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - ☒ C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☐ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- ☐ B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- ☐ C. Blowing bubbles. They are similar because they both float until they eventually pop.
- ☐ D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- ☐ B. Getting pink eye. They are similar because they are both contagious.
- ☒ C. Getting the flu. They are similar because they are both caused by not washing your hands.
- ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
- ☐ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 22 years

What is your home zip code? 48104

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other



STUDENT NAME: A42501575  
Version B

GROUP: C7

67

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - B ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - B ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - C ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- A ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - C ☒ c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - C ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - B ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - D ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - B ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

24

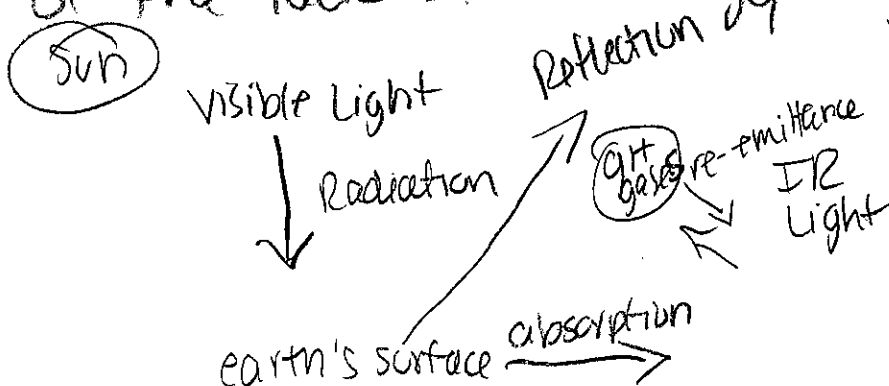
Ocean water absorbs  $\text{CO}_2$  more easily than other  $\text{CO}_2$  reservoirs, and cold water absorbs  $\text{CO}_2$  more easily than warmer water. When  $\text{CO}_2$  is absorbed into the ocean, it is creating an equilibrium between 2 reservoirs, Ocean and atmosphere. If the temperature of the oceans were to increase, the  $\text{CO}_2$  would more readily be released due to the molecules moving faster, allowing the gases to escape. If the atmosphere had an increase in  $\text{CO}_2$ , ocean acidification would also increase which affects the pH balance that is essential for maintaining many life forms. Positive feedback loop may continue to increase atmospheric  $\text{CO}_2$  due to higher temps. which release more gases into the atmosphere. Negative feedback loop may decrease atmospheric  $\text{CO}_2$  once the ocean has absorbed the  $\text{CO}_2$  in cold water preventing it from being easily released back into the atmosphere.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect occurs when heat becomes trapped in the Earth's atmosphere. The heat comes from visible wavelengths from the sun. The heat that is absorbed into the Earth's surface can be re-emitted back and forth because it is trapped by greenhouse gases. The Earth's surface absorbs the heat which can contribute to volcanism (increase in  $\text{CO}_2$  in the atmosphere). The large ash clouds block out the visible wavelengths from the sun causing less absorption and re-emittance of IR energy. The atmospheric temperature would decrease because of the lack of IR energy being radiated back.



unclear  
18

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

The both use thermal energy in their processes, and when temperatures rise

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

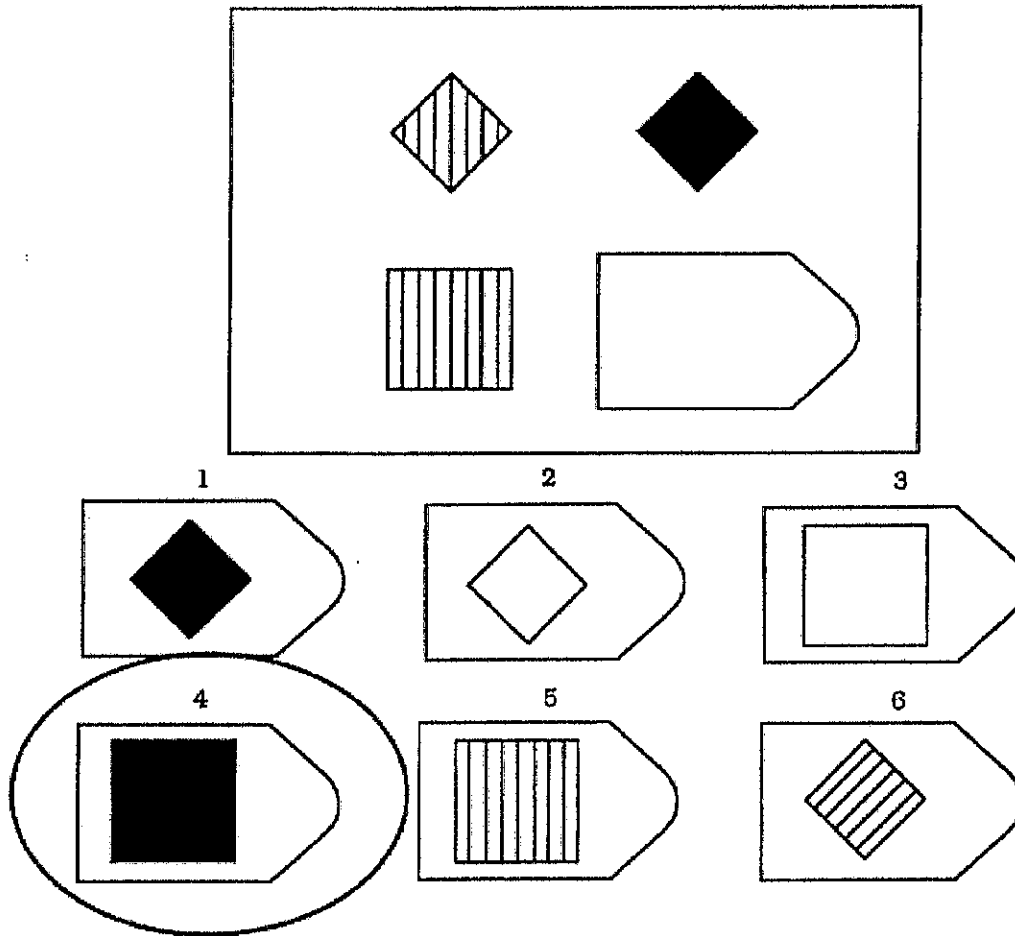
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

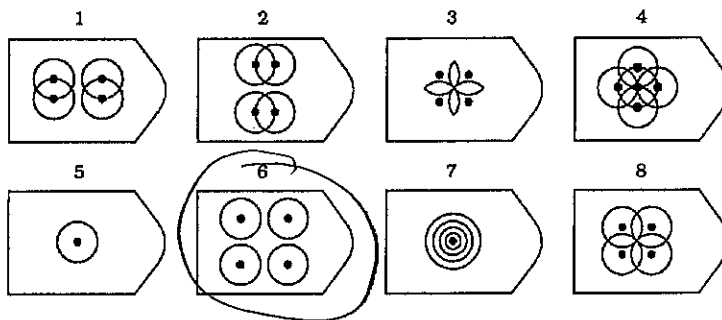
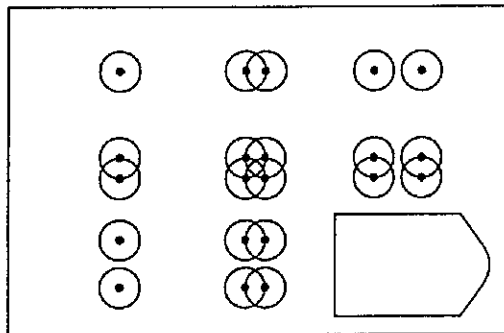


Answer: 4

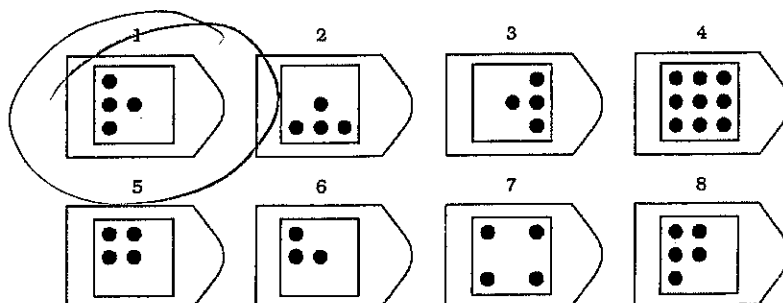
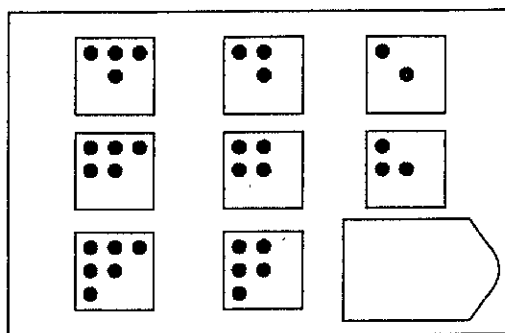
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Please choose the image that best completes each of the following patterns.

### PATTERN 1



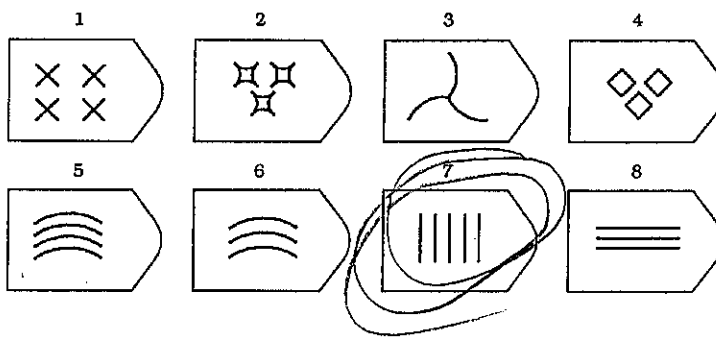
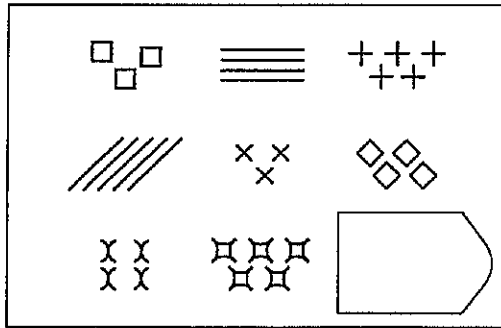
### PATTERN 2



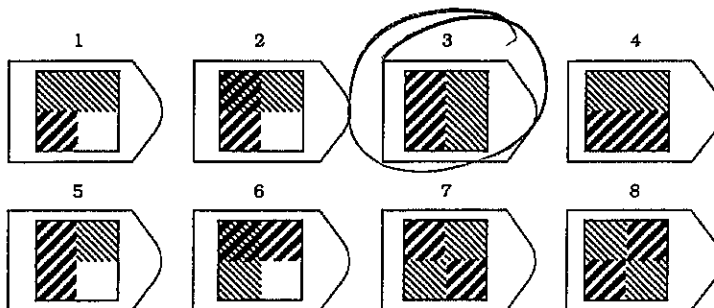
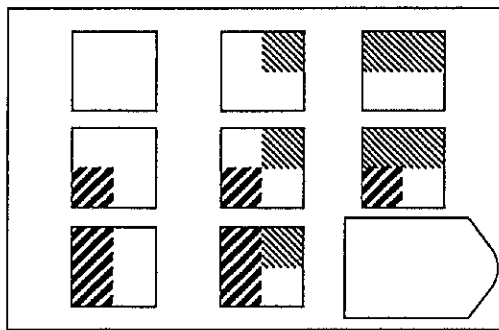
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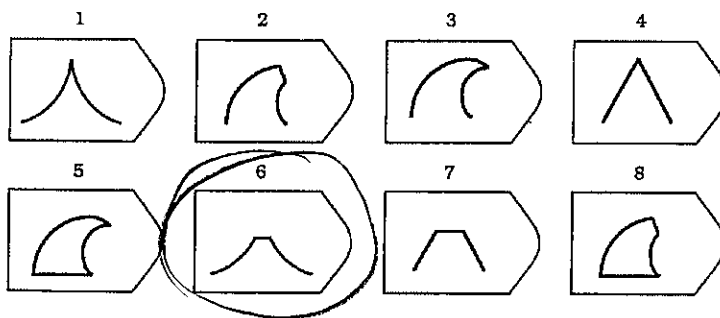
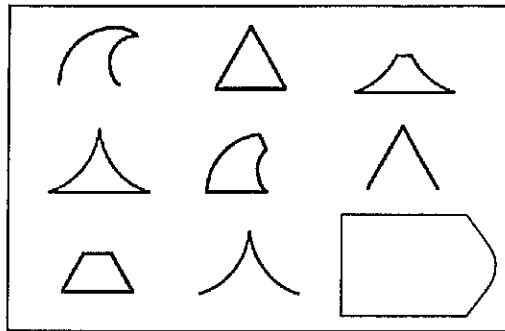


## PATTERN 3



## PATTERN 4



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

A42561575

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 25 years

What is your home zip code? 48114

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A42135792

GROUP: C7

Version B

82

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☐ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☐ a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - ☐ c. The surrounding crust becoming hotter
  - ☐ d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - ☐ b. Natural processes are the primary cause of the greenhouse effect.
  - ☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - ☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - ☐ e. The human and natural causes of the greenhouse effect are not understood.
- A > B
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- $RT = \text{size} \div \text{inflow/outflow}$   
 $6 \div 2 = 3$
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

↑ temp. ↓ acid.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- The reservoir will eventually disappear.
  - ☒ The reservoir is not in equilibrium.
  - The reservoir is growing smaller.
  - The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ The Earth's atmosphere would become colder than it is today.
  - The Earth's atmosphere would become warmer than it is today.
  - The Earth's atmosphere would remain about the same temperature as it is today.
  - The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ Reflection of more solar radiation, causing atmospheric temperature to decrease
  - Reflection of more solar radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

- The process of ocean acidification deals with the balance of carbon. As carbon tries to reach equilibrium, the acidity of oceans is in flux. As carbon increases in the atmosphere, it also increases in oceans to balance. However, as carbon in the atmosphere increases, so does temperature, which in turn heats the water making it less acidic because warmer water holds less carbon because the molecules are moving faster and bounce the carbon ions back out to the atmosphere. Carbon + water  $\leftrightarrow$  bicarbonate ions.
- Negative feedback loop: increase in atmospheric carbon dioxide  $\rightarrow$  increase in oceanic carbon dioxide  $\rightarrow$  decrease in acidity.  
 - This is a negative feedback loop because the increase of carbon dioxide creates an opposite effect because the amount of acidity decreases.

Positive feedback loop: increase in atmospheric  $\text{CO}_2$   $\rightarrow$  increase in oceanic  $\text{CO}_2$   $\rightarrow$  increase in temperatures

- This is a positive feedback loop because the increase of  $\text{CO}_2$  in the atmosphere leads to an increase in temperature of the ocean which is increasing the effect.

25 OK

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Earth's atmospheric temperature would decrease because of the Greenhouse effect and due to cloud cover. The Greenhouse effect starts with energy given off from the sun in the form of visible light and small amounts of infrared radiation and ultraviolet radiation. The Earth's surface then reflects energy in the form of IR back into the atmosphere where greenhouse gases and clouds trap/absorb some of it and turn it into heat to heat the atmosphere. The reason why the temperature would decrease is because the sun's energy wouldn't be able to reach the Earth's surface in order to be reflected back as IR (heat). This is connected to regular cloud cover as well. The more clouds in the sky, the less radiation able to reach the surface which cools the Earth's surface (or feels cooler). This is why temperatures tend to be lower on a really cloudy day. This means that an increase in volcanism will create a decrease in temperature.

20

Extra credit (2 points).

- 2 How are evaporation and degassing similar and/or different?

They are different because evaporation is taking a liquid form and turning it into a gaseous form whereas degassing is taking a gaseous liquid form and turning it into a gas.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

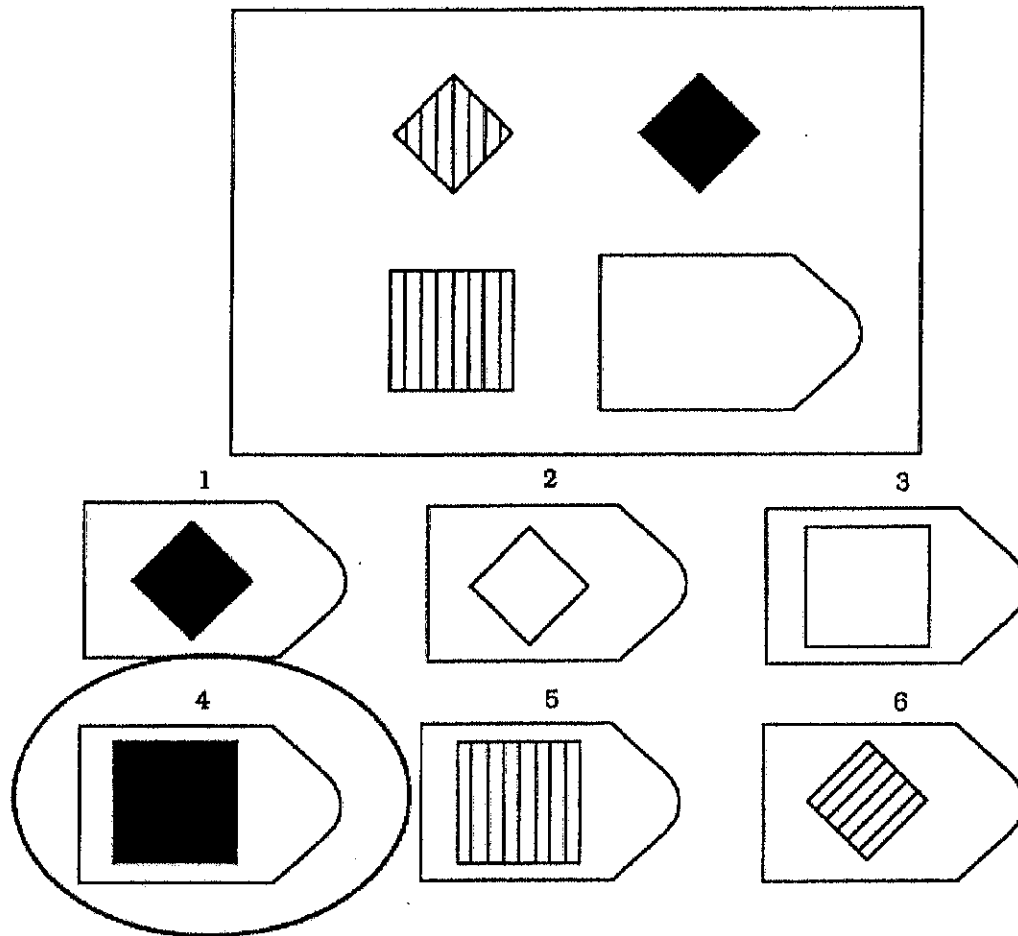


# Analogical Assessment

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In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

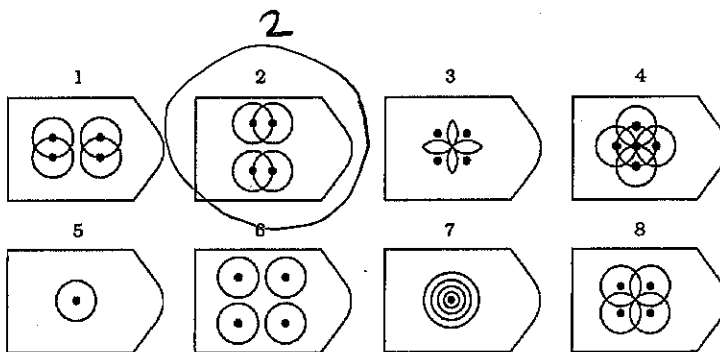
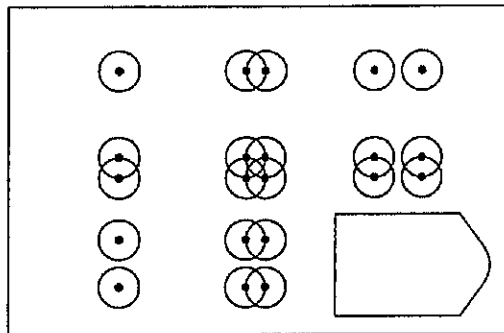


**Answer: 4**

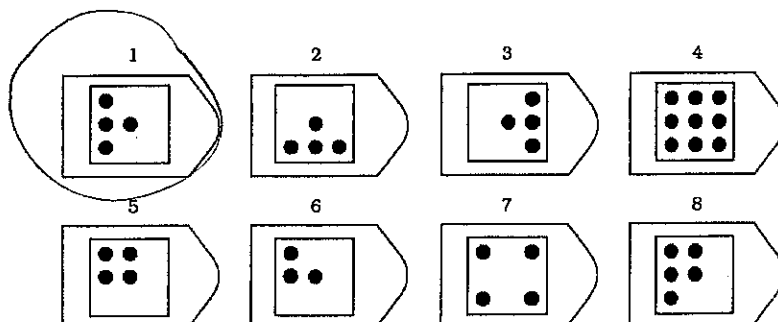
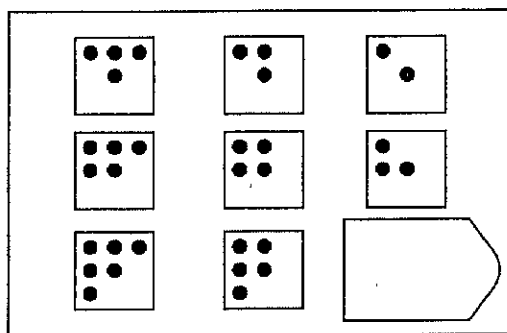
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

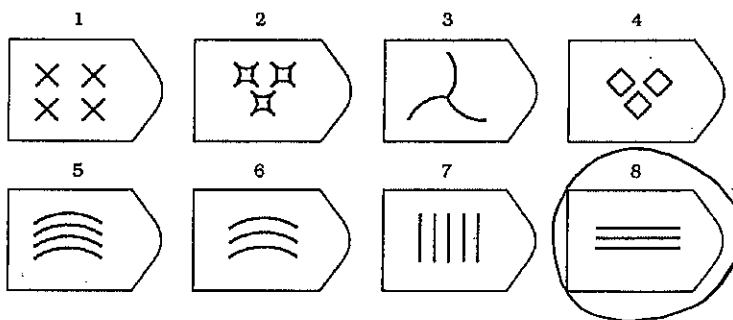
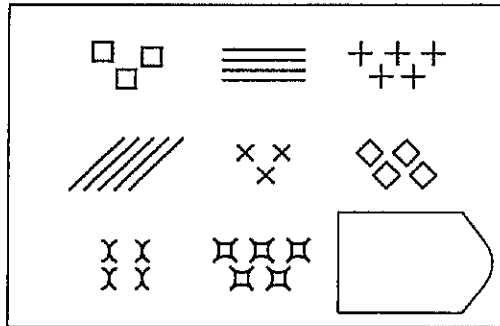
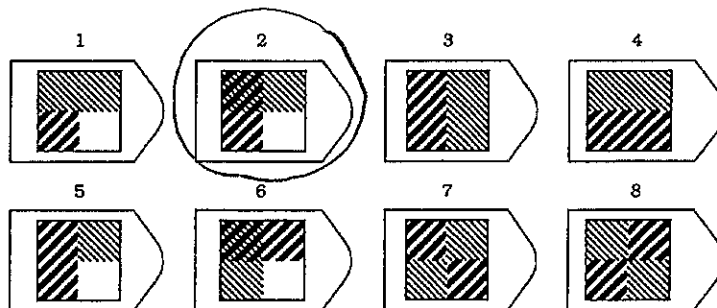
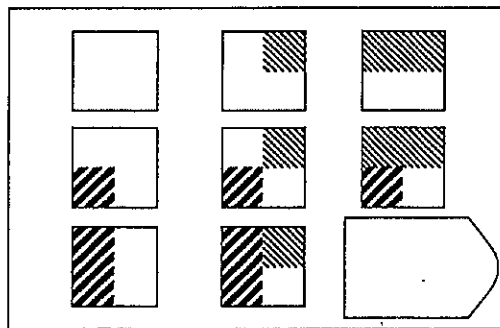
### PATTERN 1

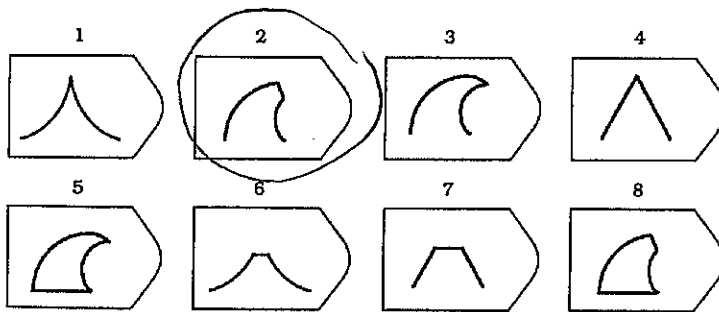
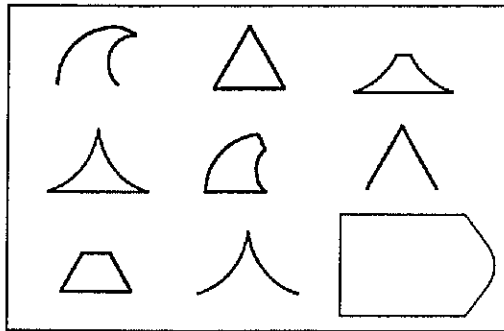


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

☒ B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48324

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A42100583  
Version B

GROUP: C7

89

MULTIPLE-CHOICE. 5 points each (50 points total).

- D 1. Which of the following would be considered a negative feedback to increasing global temperature?
- ~~a.~~ Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ~~b.~~ Melting of permafrost resulting in more methane escaping into the atmosphere
  - ~~c.~~ An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- B 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- C 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ~~a.~~ A= erosion, B= deposition, C= uplift and erosion
  - ~~b.~~ A= erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A= dissolution, B= deposition, C= uplift and deposition
- B 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ~~a.~~ Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - ~~d.~~ Neither human activities nor natural processes are important causes of the greenhouse effect.
  - ~~e.~~ The human and natural causes of the greenhouse effect are not understood.
- B 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- B 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ~~c.~~ A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ~~a.~~ The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ~~c.~~ The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- D 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- A 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ~~b.~~ Reflection of more solar radiation, causing atmospheric temperature to increase
  - ~~c.~~ Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- B 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ~~a.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ~~c.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

23

Ocean acidification is the increase of the amount of  $\text{H}^+$  atoms in the oceans, causing the oceans to be more acidic. This is caused by an increase in atmospheric  $\text{CO}_2$ . The equation:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$  helps explain why this is. When more  $\text{CO}_2$  is added into this equation, it becomes unbalanced and therefore the process needs to run from left to right ( $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{HCO}_3^- + \text{H}^+$ ) in order to get back to equilibrium. This flow from left to right causes an increase of  $\text{H}^+$  atoms, and therefore increasing the acidity of the oceans. A positive feedback loop in this process is when an increase in  $\text{CO}_2$  in the atmosphere increases the acidity of the oceans and therefore causing another process to increase  $\text{CO}_2$  in atmosphere and therefore causing ocean acidity to increase more.

A negative feedback loop in this process is when an increase in  $\text{CO}_2$  in the atmosphere increases the acidity of the oceans, therefore decreasing the amount of  $\text{CO}_2$  in the atmosphere and eventually decreasing the acidity of the oceans.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect is the process by which greenhouse gases (example:  $\text{CO}_2$ ) "trap" heat inside Earth's atmosphere. The radiation from the sun is mostly visible light when it enters the atmosphere, and most of this visible light is absorbed by Earth's surface and re-radiated out as infrared (heat) energy. Greenhouse gases absorb this infrared energy and re-radiate it out in all directions. This process essentially "traps" in heat and warms the atmosphere.

Volcanism erupts huge ash clouds into the atmosphere and therefore cause a decrease in atmospheric temperature because the ash reflects solar radiation back out into space, therefore not allowing as much visible light into the atmosphere to be used for the greenhouse effect.

When the volcanism suddenly increases, the Earth's atmospheric temperature will decrease because of all the ash erupted into the atmosphere.

But when all the ash eventually falls out of the atmosphere, the atmospheric temperature will increase because there would be more visible light entering the atmosphere, and therefore more infrared (heat) energy being re-radiated from the Earth and greenhouse gases.

25

1

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are similar because they both involve the forming of gases. But they are different because evaporation is from liquid to gas and degassing involves creating gas bubbles in magma.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

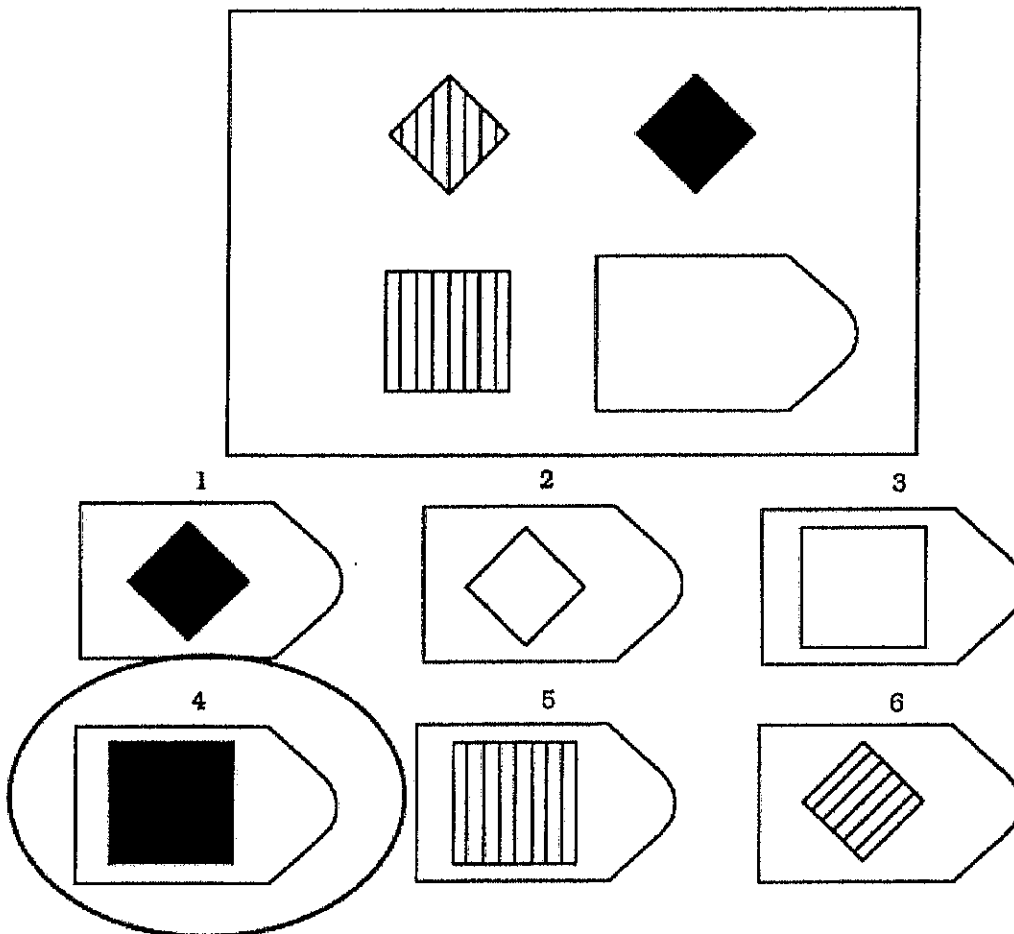
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

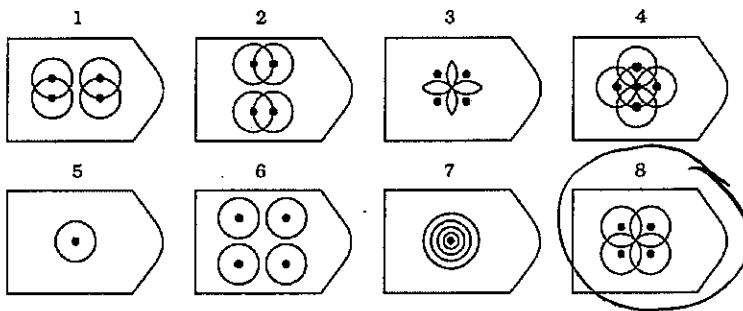
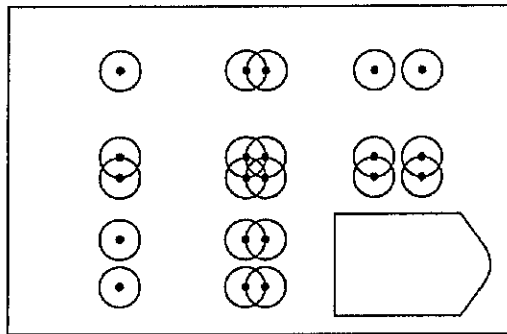
*Example*



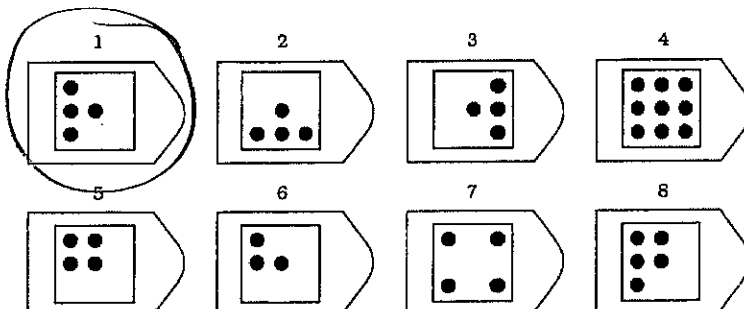
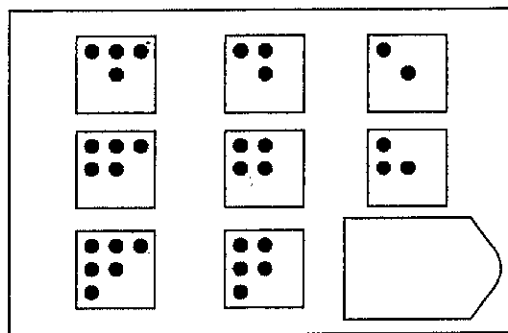
**Answer: 4**

Please choose the image that best completes each of the following patterns.

### PATTERN 1

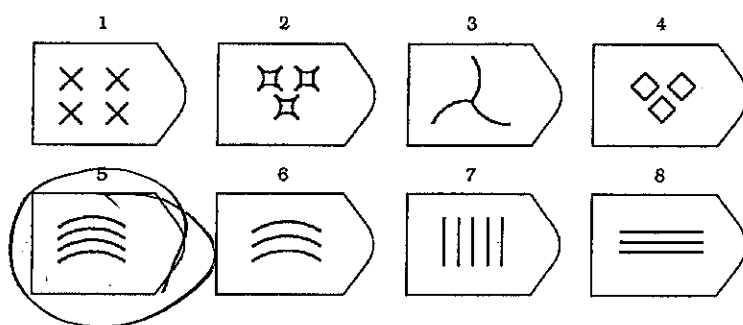
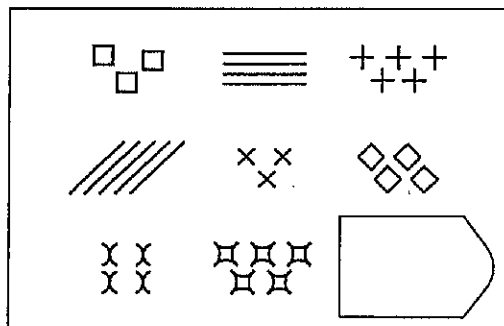


### PATTERN 2

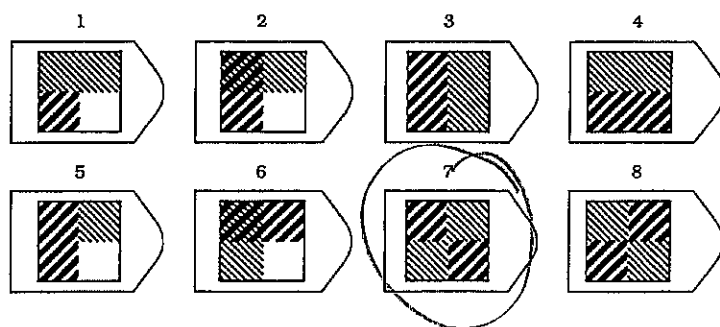
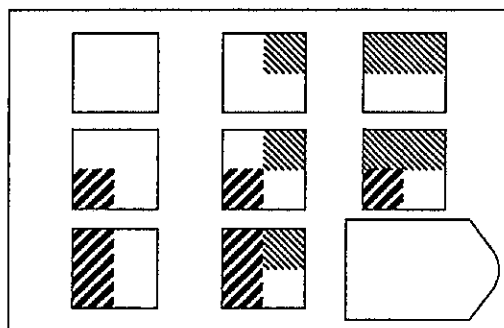


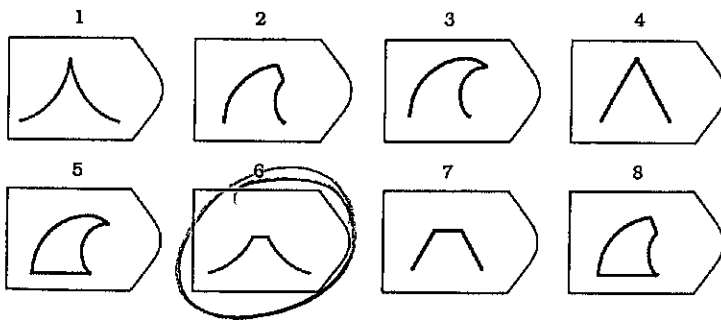
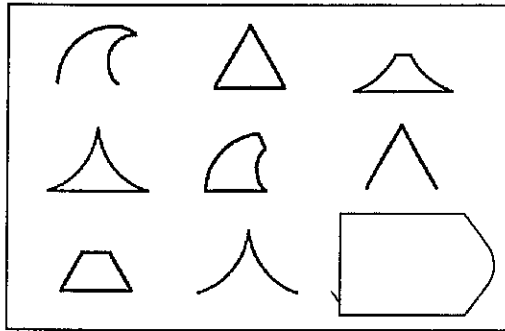


**PATTERN 3**



**PATTERN 4**



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.

☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.

C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.

D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

---

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

A. Getting high. They are both involve too much of a chemical influencing the body.

B. Hitting your head. They both involve something that causes headaches.

☒ C. Being sleep deprived. They both involve impaired functions.

D. Eating too much candy. They both involve lack of self-control.

E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

A. Dew forming. They are similar because they both involve a drop in temperature.

B. Blowing up a balloon. They are similar because they both involve becoming less dense.

☒ C. Clouds forming. They are similar because they both involve a phase change.

D. Building a house. They are similar because they both involve building a structure.

### DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48188

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

STUDENT NAME: A 42326587  
Version B

GROUP: C7

55

MULTIPLE-CHOICE. 5 points each (50 points total).

- A 1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat ↓
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- D 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- C 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A= erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A= dissolution, B= deposition, C= uplift and deposition
- B 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- B 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.  $\frac{1}{1} = 1 \quad \frac{2}{1} = 2$
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- A 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of 50  $\text{km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- A 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- D 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☒ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- B 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

When there is more carbon dioxide in the atmosphere, there is more availability for carbon dioxide absorption to take place in the ocean. As carbon is absorbed, the ocean becomes more acidic. There is an increase in  $\text{CO}_2$  in the air and increase in the ocean so this is a positive feedback. On the contrary to this, when the  $\text{CO}_2$  levels become higher in the ocean, the ocean also loses its ability to absorb as much, so there is also an increase in  $\text{CO}_2$  in atmosphere that can lead to a decrease in  $\text{CO}_2$  absorption in the ocean which would be a negative feedback loop. Both of these feedback loops are completely possible with atmospheric and ocean  $\text{CO}_2$  levels.

20

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

When a volcano erupts, a significant amount of ash is released into the air creating ash clouds. This has the chance to lower atmospheric temperatures and here is why:

X The greenhouse effect results in warming of the atmosphere. When radiation from the sun enters the atmosphere and reflects back, the infrared radiation is absorbed by greenhouse gases (for ex. Carbon and water) and results in a warmer. Greenhouse effect is a natural process. Ash clouds would inhibit this process by blocking the radiation from the sun. With decreased absorption of infrared radiation in greenhouse gases, there is a decrease in atmospheric temperatures.

5

on

X Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are similar because there is a change in thermal and gravitational energy but there are two different types of gases being moved ( $H_2O$  vs  $CO_2$ ).



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

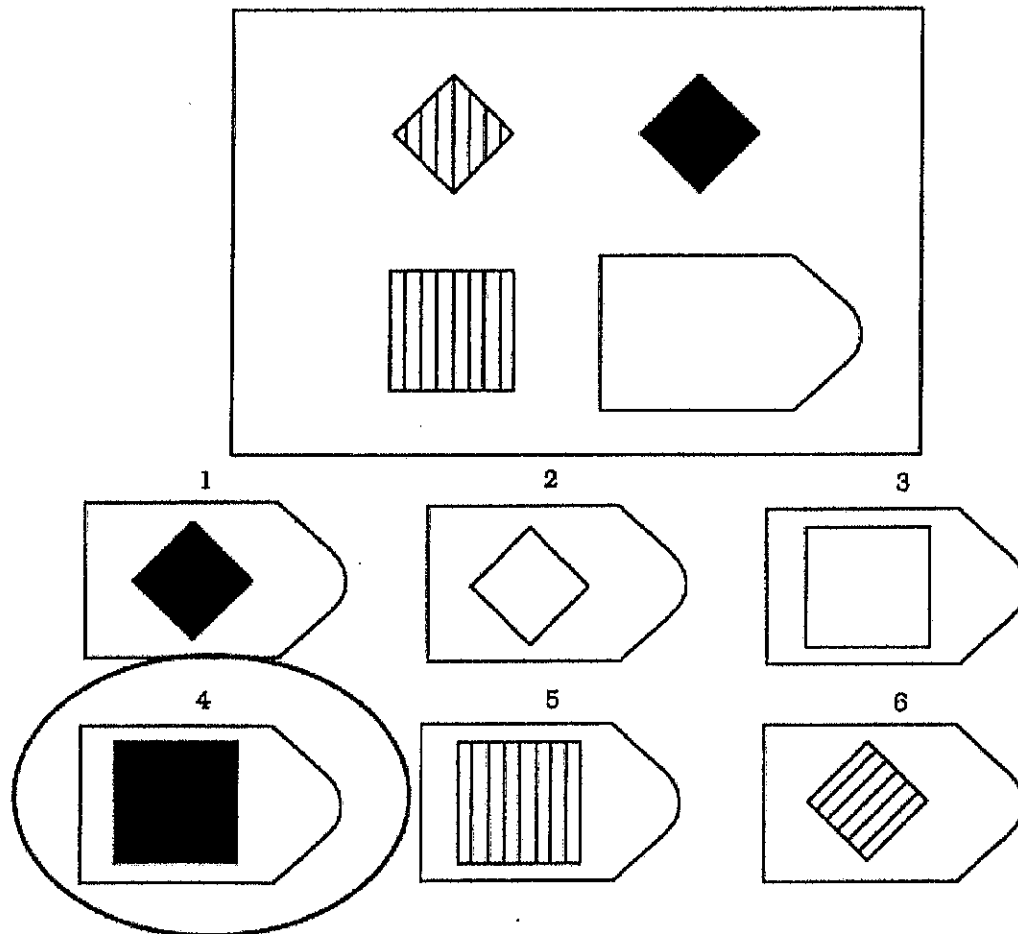
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

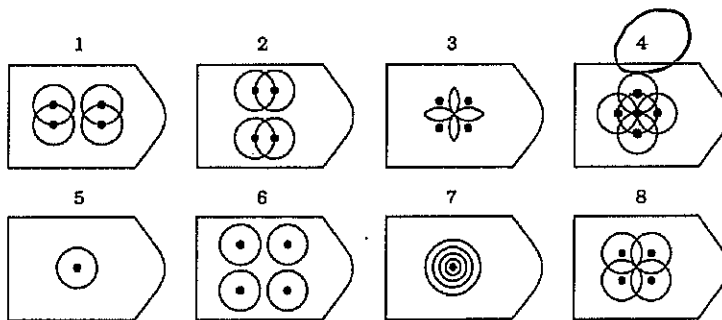
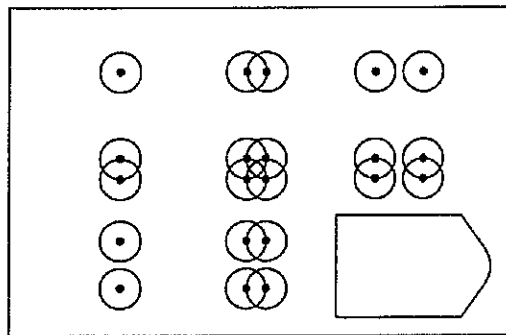


**Answer: 4**

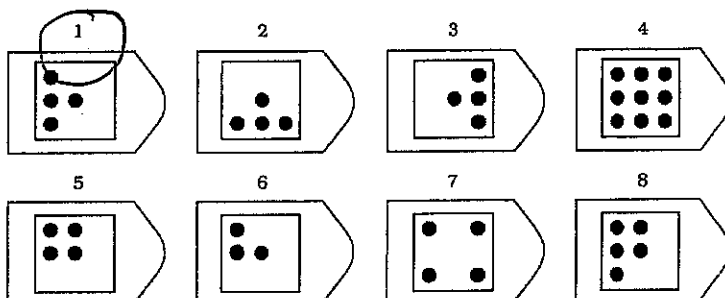
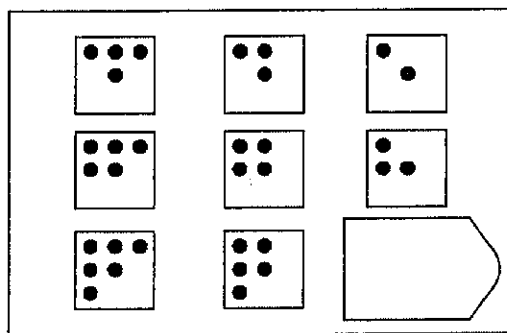
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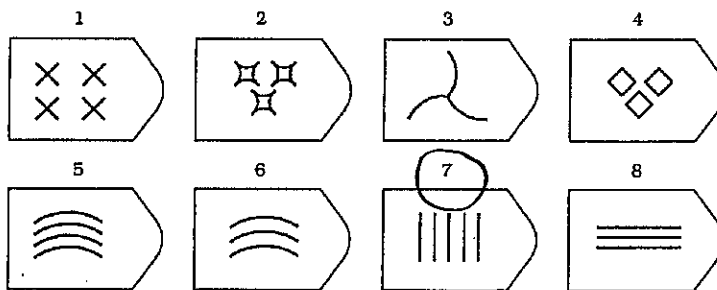
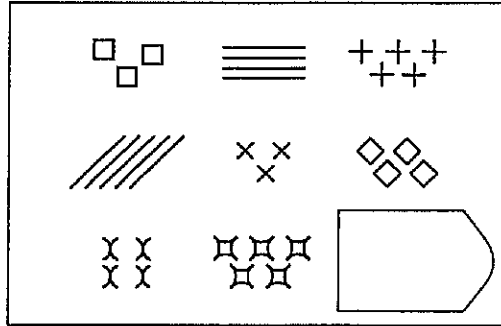
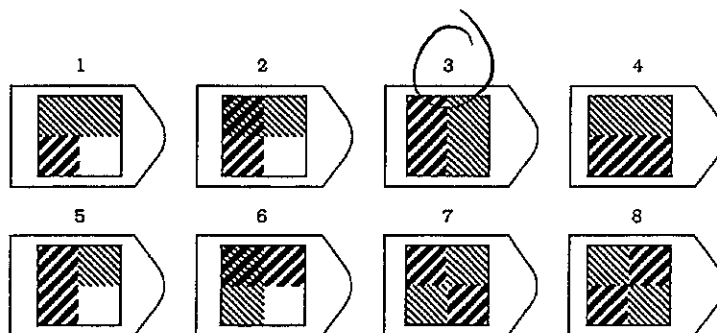
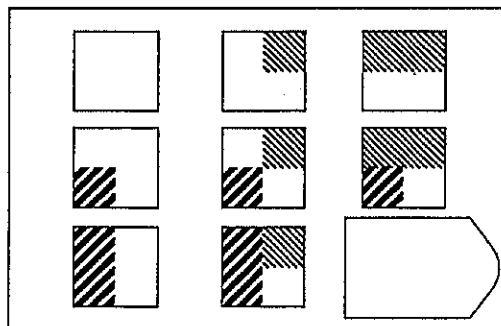
Please choose the image that best completes each of the following patterns.

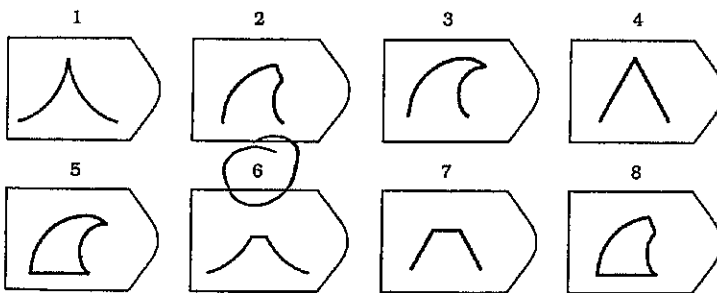
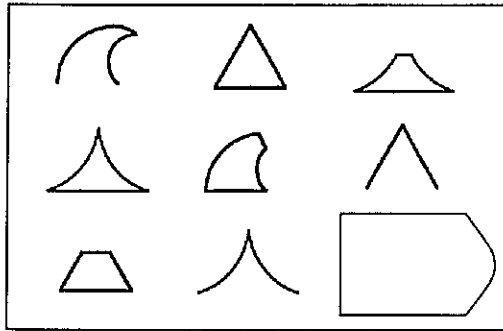
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
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- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

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PLEASE CONTINUE ON NEXT PAGE

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- 

Please choose the response that is closest to an analogy that you might make.

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2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48169

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

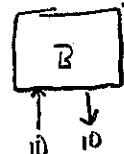
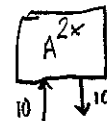
STUDENT NAME: A42311768  
Version B

GROUP: C8

42

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- ☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
- ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
- ☐ c. An increase in evaporation and cloud formation resulting in the release of latent heat
- ☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☐ a. The magma becoming colder
- ☒ b. Gas bubbles forming in the magma
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3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
- ☐ b. A = erosion, B= biochemical precipitation, C= uplift and deposition
- ☐ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
- ☐ d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☐ a. Human activities are the primary cause of the greenhouse effect.
- ☐ b. Natural processes are the primary cause of the greenhouse effect.
- ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
- ☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
- ☐ e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☐ a. Reservoir A has a shorter residence time than Reservoir B.
- ☒ b. Reservoir B has a shorter residence time than Reservoir A.
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- ☐ d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☐ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
- ☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
- ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- C
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric  $\text{CO}_2$  would affect ocean acidification by increasing its acidity. Because  $\text{CO}_2$  is a gas, it causes things to become more acidic such as ocean acidification.

15 A positive feedback loop within ocean acidification would be a change in which causes the same reaction to happen throughout the ocean such as adding  $\text{CO}_2$ , which would cause acidity levels to increase throughout the whole ocean reservoir. A negative feedback loop would be that of which causes different reactions. This could be caused by a  $\text{CO}_2$  increase with another gas which could cause some acidity levels to increase and some to decrease.



The equation above shows that when  $\text{CO}_2$  is added to water ( $\text{H}_2\text{O}$ ) the system is at equilibrium with Hydrogen carbonate and hydrogen.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

An increase in volcanism and volcanoes that erupt ash clouds would cause a decrease in the earth's temperature. This decrease in temperature would occur due to the large ash clouds that form. These large ash clouds would form in our atmosphere and block some of the energy that our sun is emitting. Some energy would still get through the blockage but there would still be a large amount in which is blocked. The greenhouse effect is caused by all of the greenhouse gases which are currently in our atmosphere. The greenhouse effect causes our earth's temperature to decrease due to the blockage in energy from which the sun is giving off. If these volcanoes were not causing large ash clouds it would likely cause an increase in temperature due to the gases that would be released.

*explain*

*ok*

5

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing both change the states of a material. Evaporation changes a liquid to a gas (vapor) while degassing changes a material out of its gaseous state.

*2 ok*

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

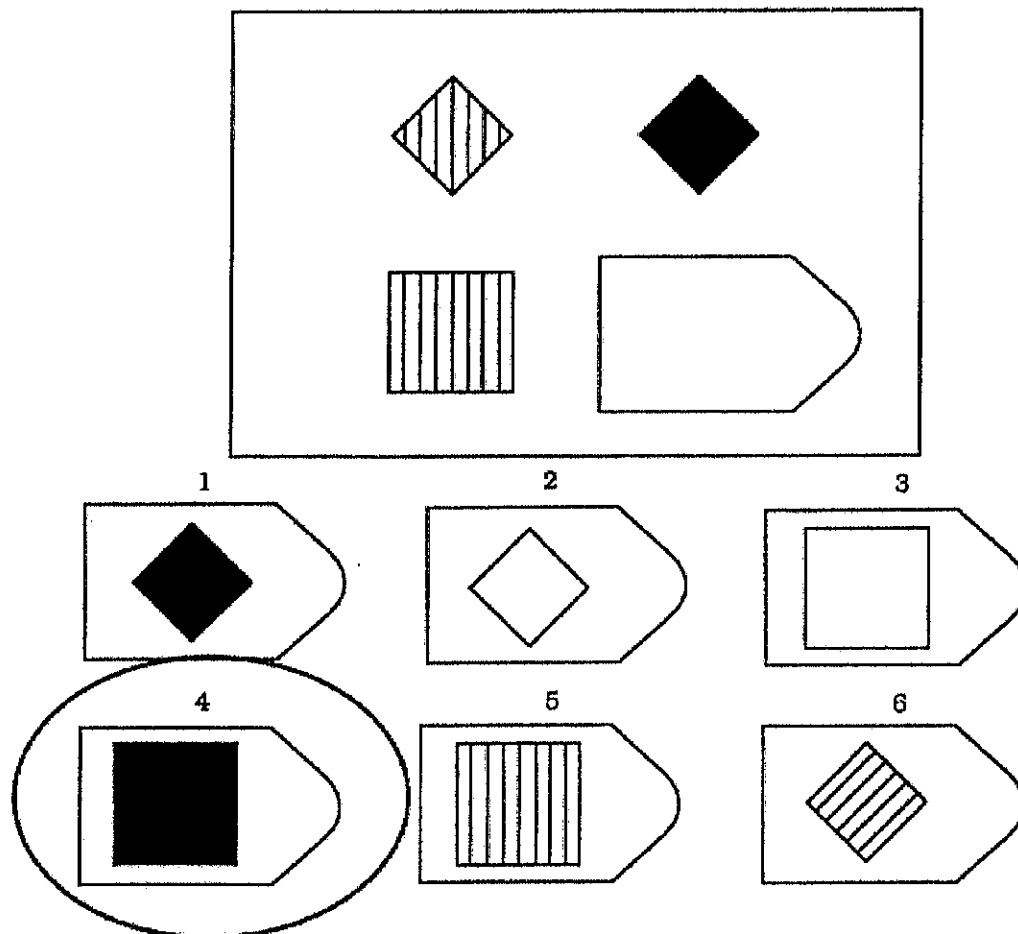
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



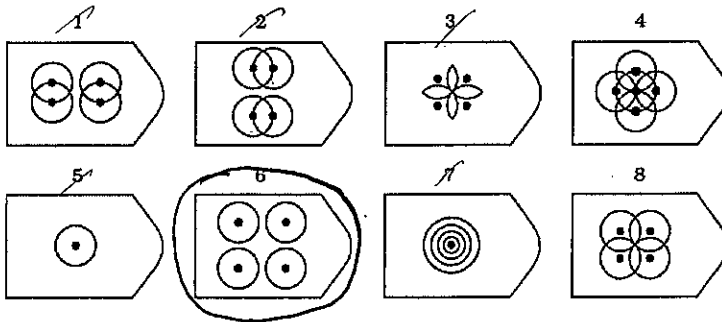
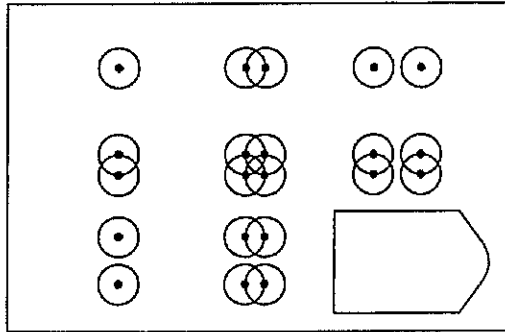
**Answer: 4**

PLEASE CONTINUE ON NEXT PAGE

A42311768

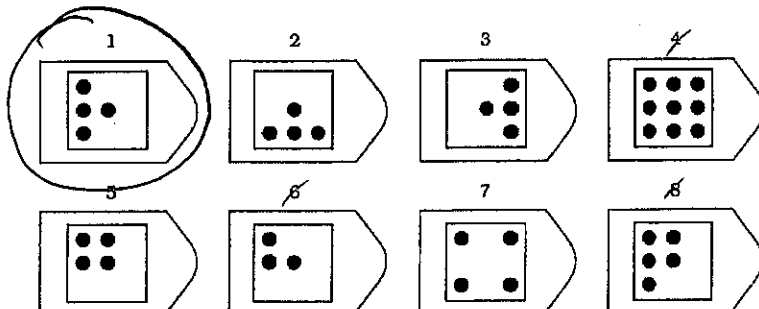
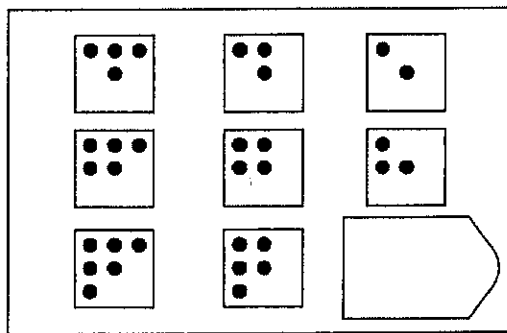
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### PATTERN 1



6

### PATTERN 2

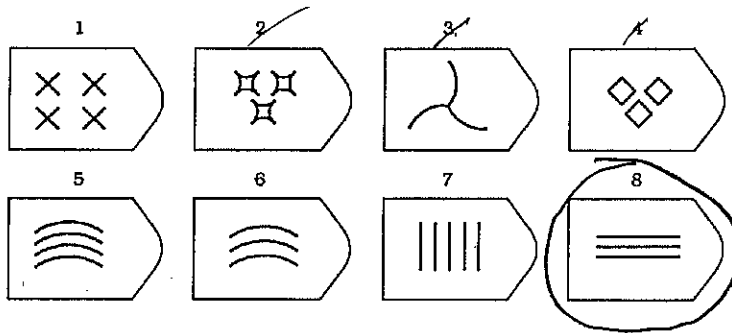
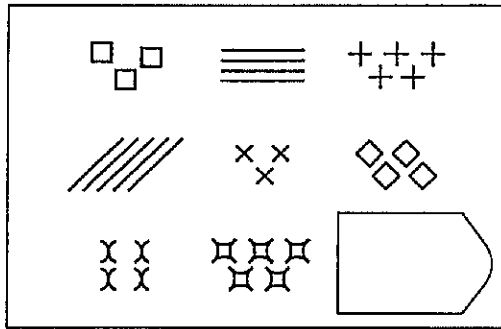


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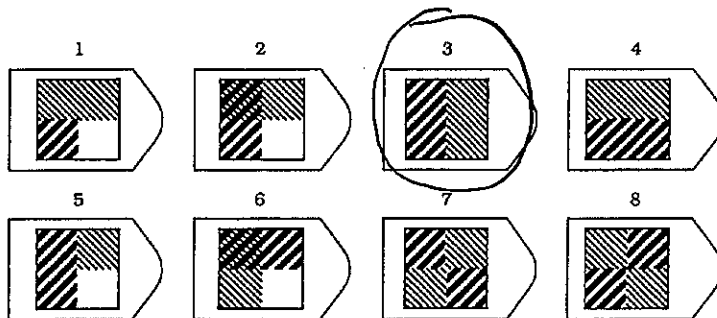
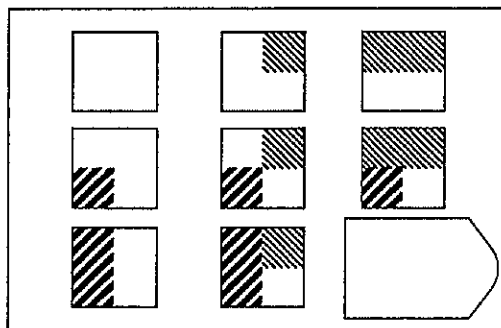
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## PATTERN 3



8

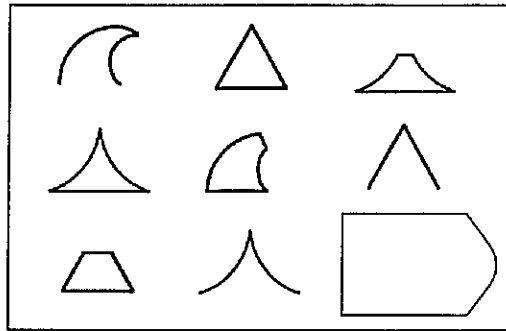
## PATTERN 4



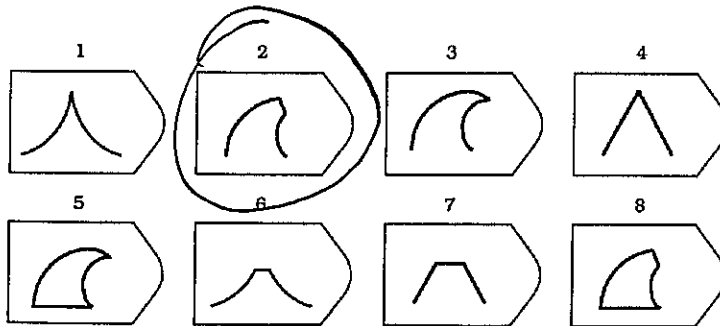
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A42311768

## PATTERN 5



2



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

A42311768

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

A42311768

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.

B ☒ B Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.

C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.

D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

---

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

A. Getting high. They are both involve too much of a chemical influencing the body.

☒ B Hitting your head. They both involve something that causes headaches.

C. Being sleep deprived. They both involve impaired functions.

D. Eating too much candy. They both involve lack of self-control.

E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

A. Dew forming. They are similar because they both involve a drop in temperature.

B. Blowing up a balloon. They are similar because they both involve becoming less dense.

☒ C Clouds forming. They are similar because they both involve a phase change.

D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48322

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

STUDENT NAME: A40833474  
Version A

GROUP: C8

68

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- D*
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- A*
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- C*
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition

*3*  
*The natural processes are the primary cause of the greenhouse effect.*

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- a. Human activities are the primary cause of the greenhouse effect.
- ☒ b. Natural processes are the primary cause of the greenhouse effect.
- c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
- d. Neither human activities nor natural processes are important causes of the greenhouse effect.
- e. The human and natural causes of the greenhouse effect are not understood.

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- C*
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- A*
- ☒ a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase of atmospheric  $\text{CO}_2$  would increase the  $\text{CO}_2$  in oceans because the system attempts to reach equilibrium. The increased  $\text{CO}_2$  in the oceans leads to ~~the~~ less  $\text{H}^+$  ions, decreasing the pH of the oceans, leading to higher ocean acidification. The positive feedback loop in this scenario is that, due to the carbon cycle, the  $\text{CO}_2$  is retransferred into the atmosphere and the process starts again, making the oceans more acidic. The increase in  $\text{CO}_2$  does, however, warm the atmosphere, which leads to warmer oceans, which are not as good as colder water at absorbing the  $\text{CO}_2$ , therefore causing a negative feedback loop.

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Large ash clouds that block the upper atmosphere would lead to less visible light from the sun reaching the Earth, making the greenhouse effect less prevalent. The greenhouse effect is the process by which sun's visible light is emitted to Earth, and some of the energy is not trapped by greenhouse gases, allowing it to travel back through the atmosphere. Some of the energy, however, is altered by greenhouse gases, causing it to be re-emitted as infrared light (heat). This process continues, and heat is essentially "trapped" in Earth's atmosphere. These ash clouds, which lessen the amount of light that reaches the Earth's surface results in a decrease in infrared light which lowers the atmospheric temperature, because not as much can be re-emitted and "trapped".

not quite

18

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are similar because both involve changes which alter the remaining solution, decrease the buoyancy, and release gases as a product.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

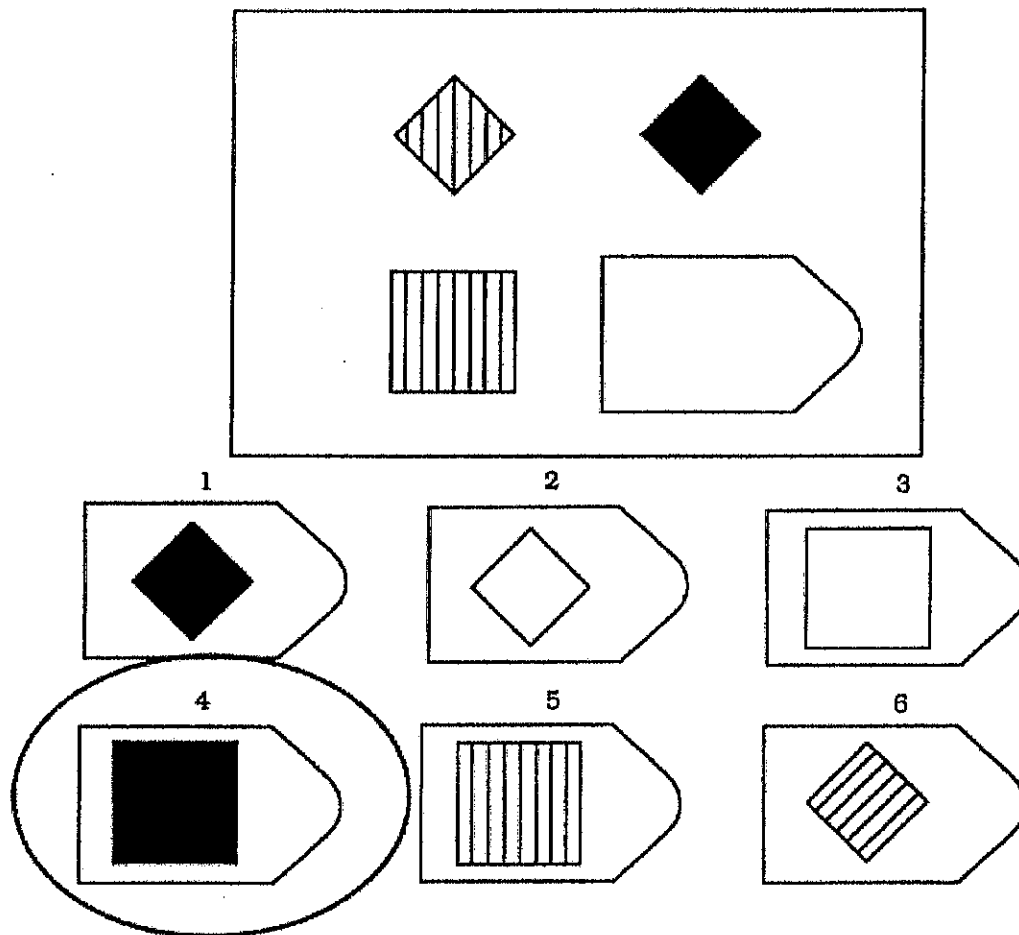


# Analogical Assessment

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In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

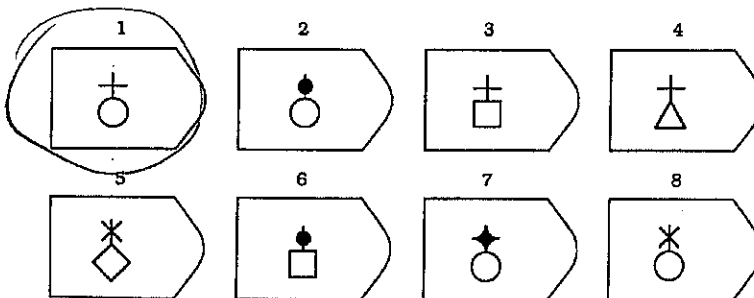
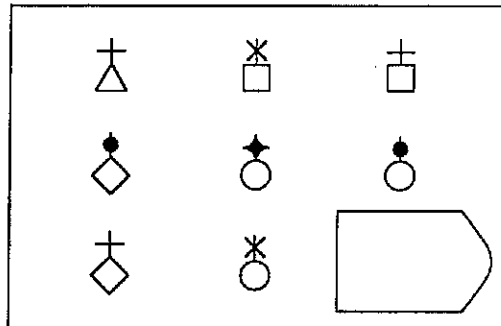


**Answer: 4**

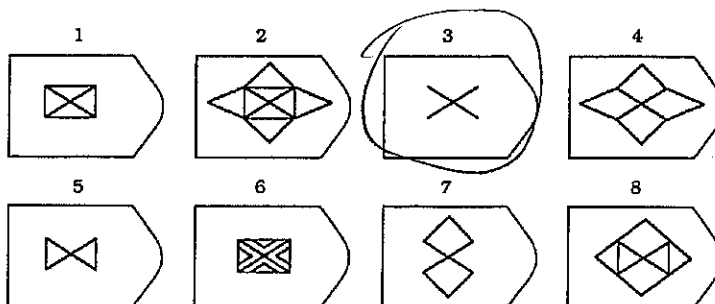
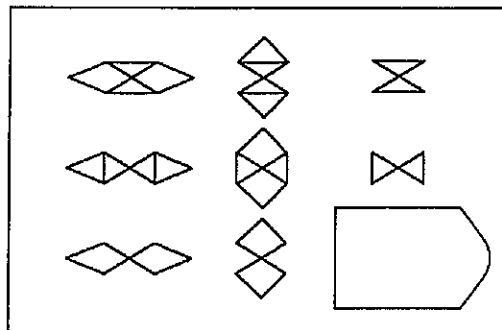
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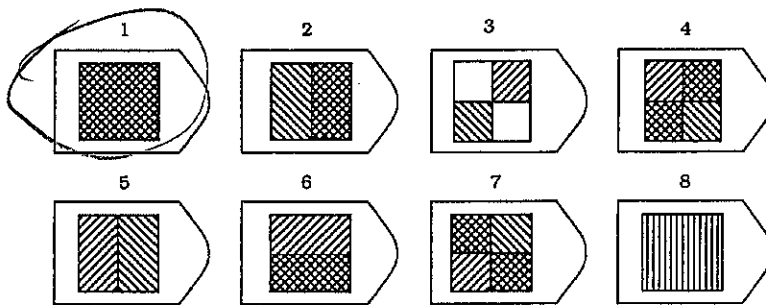
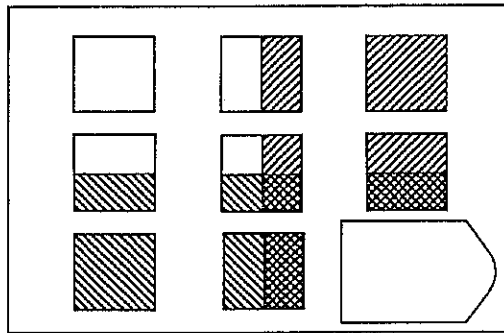
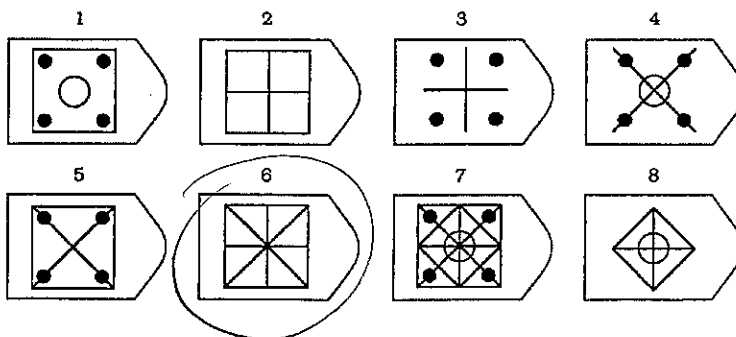
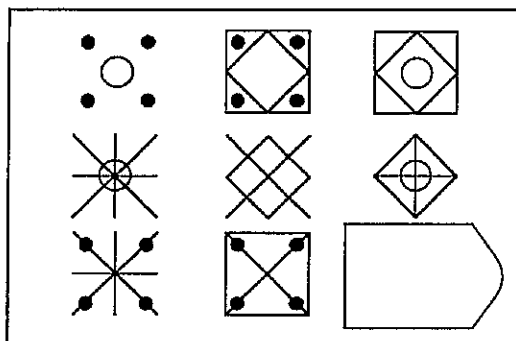
Please choose the image that best completes each of the following patterns.

### PATTERN 1

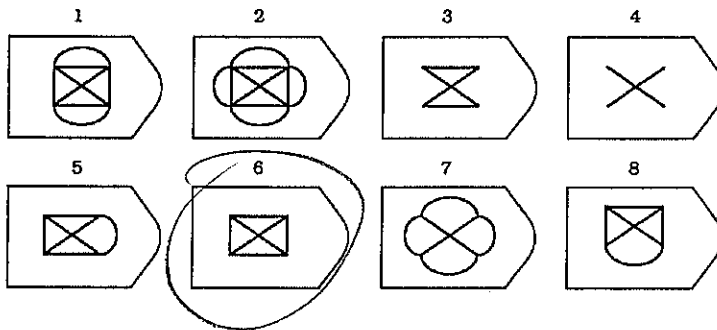
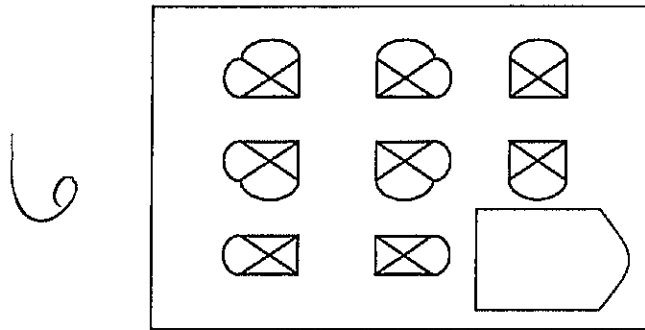


### PATTERN 2



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48823

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



STUDENT NAME: A 39223581  
Version B

GROUP: C8

65

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- 1.** Which of the following would be considered a negative feedback to increasing global temperature?
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
- ☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere
- ☐ c. An increase in evaporation and cloud formation resulting in the release of latent heat
- ☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- 2.** Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☐ a. The magma becoming colder
- ☐ b. Gas bubbles forming in the magma
- ☐ c. The surrounding crust becoming hotter
- ☐ d. Crystals forming in the magma
- 3.** Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☐ a. A= erosion, B= deposition, C= uplift and erosion
- ☐ b. A= erosion, B= biochemical precipitation, C= uplift and deposition
- ☐ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
- ☐ d. A= dissolution, B= deposition, C= uplift and deposition
- 4.** Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☐ a. Human activities are the primary cause of the greenhouse effect.
- ☐ b. Natural processes are the primary cause of the greenhouse effect.
- ☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
- ☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
- ☐ e. The human and natural causes of the greenhouse effect are not understood.
- 5.** Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☐ a. Reservoir A has a shorter residence time than Reservoir B.
- ☐ b. Reservoir B has a shorter residence time than Reservoir A.
- ☐ c. Reservoir A and Reservoir B have equal residence times.
- ☐ d. More information about Reservoir A and Reservoir B is needed.
- $$A = \frac{2}{1} = 2 \quad B = \frac{1}{1} = 1$$
- 6.** Which of the following would cause the acidity of Earth's oceans to decrease?  $\downarrow \text{CO}_2$
- ☐ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
- ☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
- ☐ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B**
- ☐ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.

$$\frac{1000}{50}$$

**A**

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- ☒ a. The Earth's atmosphere would become colder than it is today.
- ☐ b. The Earth's atmosphere would become warmer than it is today.
- ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
- ☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A**
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B**
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- a. An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- b. Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is a process which takes  $\text{CO}_2$  from the atmosphere and converts the carbon into several solutions such as  $\text{HCO}_3^-$  as well as hydrogen ions when in the ocean. A positive feedback loop for ocean acidification would be one in which more  $\text{CO}_2$  would eventually lead to more  $\text{CO}_2$  as an outcome. A negative feedback loop would have more  $\text{CO}_2$  to start, but end up with less as an outcome. Positive feedback loops enhance upon a system, whereas negative feedback loops take away from or alter a system.

Positive

- ↑ Temperature
- ↑  $\text{CO}_2$
- ↑ Ocean acidification
- ↑ Temperature

10

15

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Block solar radiation

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Volcanism increasing on Earth would have a very large impact on the atmosphere. The blocking of solar radiation due to the ash in the atmosphere would be the main cause. This impacts the greenhouse effect because it isn't allowing the visible light to pass through the atmosphere. The greenhouse effect traps in the absorbed visible light that is taken in by the soil, but if no light enters, this heating cannot occur. The greenhouse effect is what heats the Earth, so if no solar radiation can enter the atmosphere, the Earth would be very cold.

1?

15

Extra credit (2 points).

How are evaporation and degassing similar and/or different? Evaporation and degassing are similar in that they both cause a substance to become less dense, but are different in that degassing involves magma and evaporation involves water.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

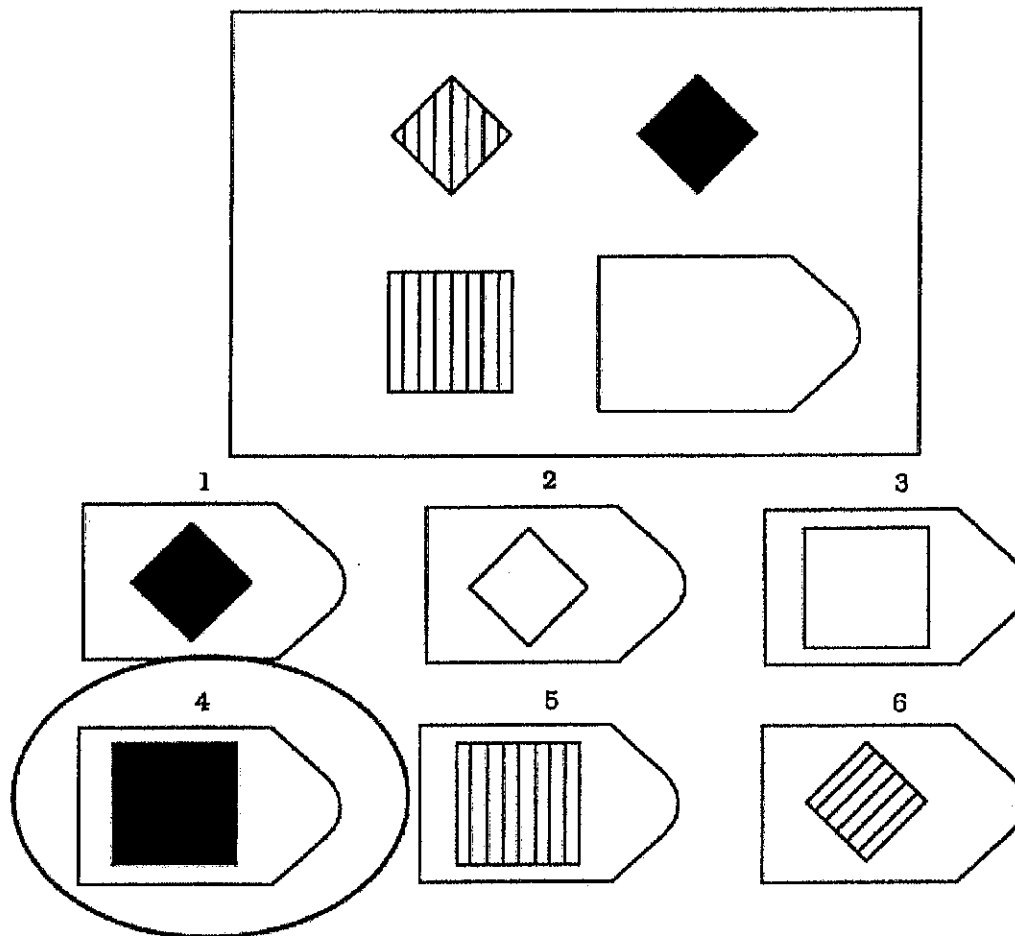
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

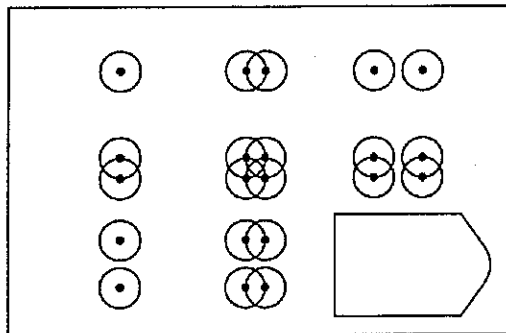


**Answer: 4**

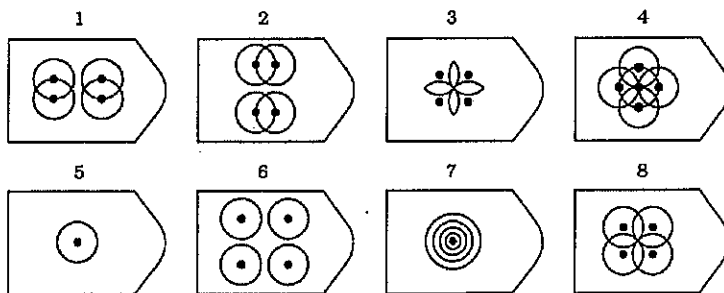
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Please choose the image that best completes each of the following patterns.

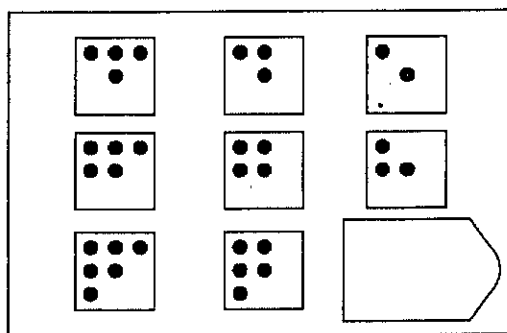
### PATTERN 1



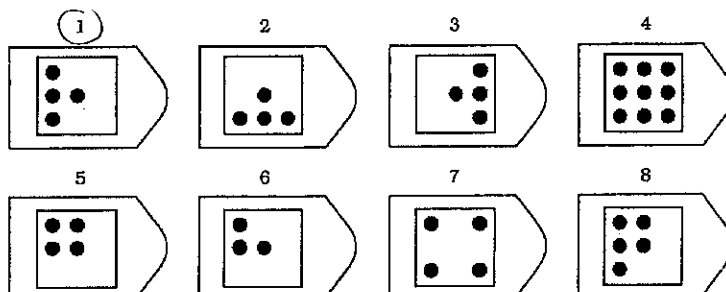
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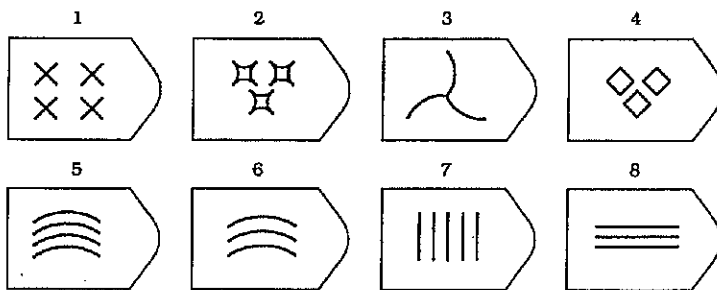
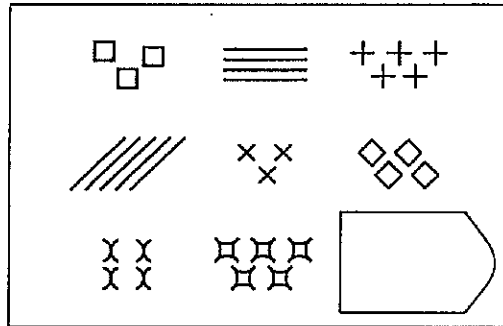
### PATTERN 2



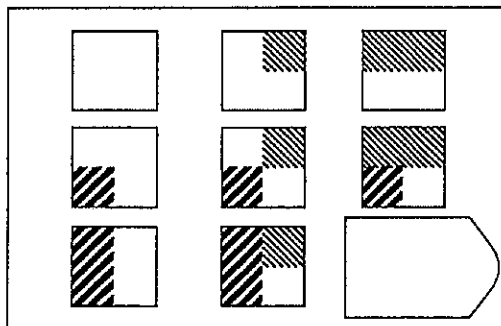
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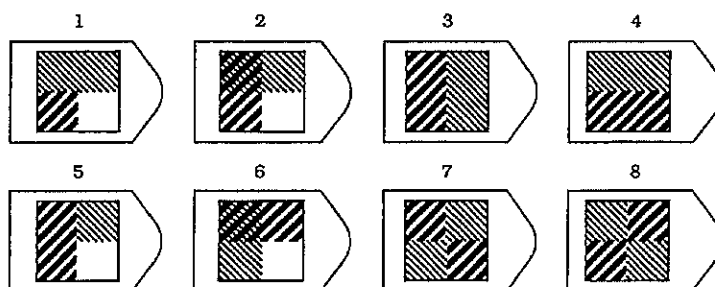


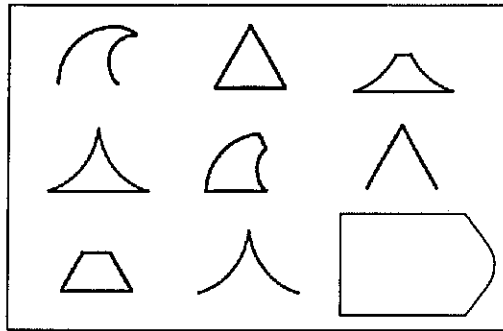
**PATTERN 3**

(8)

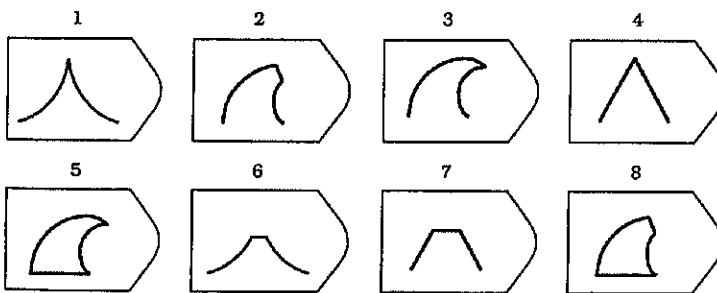
**PATTERN 4**

(4)



**PATTERN 5**

5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

**Please choose the best analogy to each of the following statements.**

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- ☒ D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- ☒ B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- ☒ A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- ☒ A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

*PLEASE CONTINUE ON NEXT PAGE*

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48823

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A43866027  
Version A

GROUP

C8

65

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - ~~d. Neither human activities nor natural processes are important causes of the greenhouse effect.~~
  - ~~e. The human and natural causes of the greenhouse effect are not understood.~~
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☒ a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ☒ b. The reservoir is not in equilibrium.
- ☐ a. The reservoir will eventually disappear.
- ☐ c. The reservoir is growing smaller.
- ☐ d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
- ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ c. The Earth's atmosphere would remain about the same temperature as it is today.
- ☐ a. The Earth's atmosphere would become colder than it is today.
- ☐ b. The Earth's atmosphere would become warmer than it is today.
- ☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide causes more heat to be trapped in the greenhouse gas. as the atmosphere warms so does the ocean. More  $\text{CO}_2$  is in the water which makes the water more acidic. As the water becomes warmer and more acidic marine life is not able to sustain itself in the conditions the reef sizes would decrease.

Feedback loops

Increase in  $\text{CO}_2 \rightarrow$  More Heat trapped  $\rightarrow$  warmer  
 X Sea waters  $\rightarrow$  More  $\text{CO}_2$  in the water  $\rightarrow$  less reef  $\rightarrow$   
 More harmful to the marine life

increase in  $\text{CO}_2$  to  $\text{CO}_2$ . More  $\text{CO}_2$  in water is a positive feedback loop - an increase leads to continuous increases in other parts of the system. After that it becomes a negative loop as the increase causes a decrease in marine life and the ecosystem under the water

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The large ash clouds would block the incoming rays coming from the sun. They would reflect off of the clouds more. This would lead to a decrease in temperature because since the rays are not coming down to the earth's surface, they are not being absorbed. and since they are not being absorbed the heat is not being trapped by the greenhouse gases. and so since there is no heat being trapped the atmospheric temperature decreases as the rays are reflected rather than absorbed.

explain

22

Extra credit (2 points).

How are evaporation and degassing similar and/or different?



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

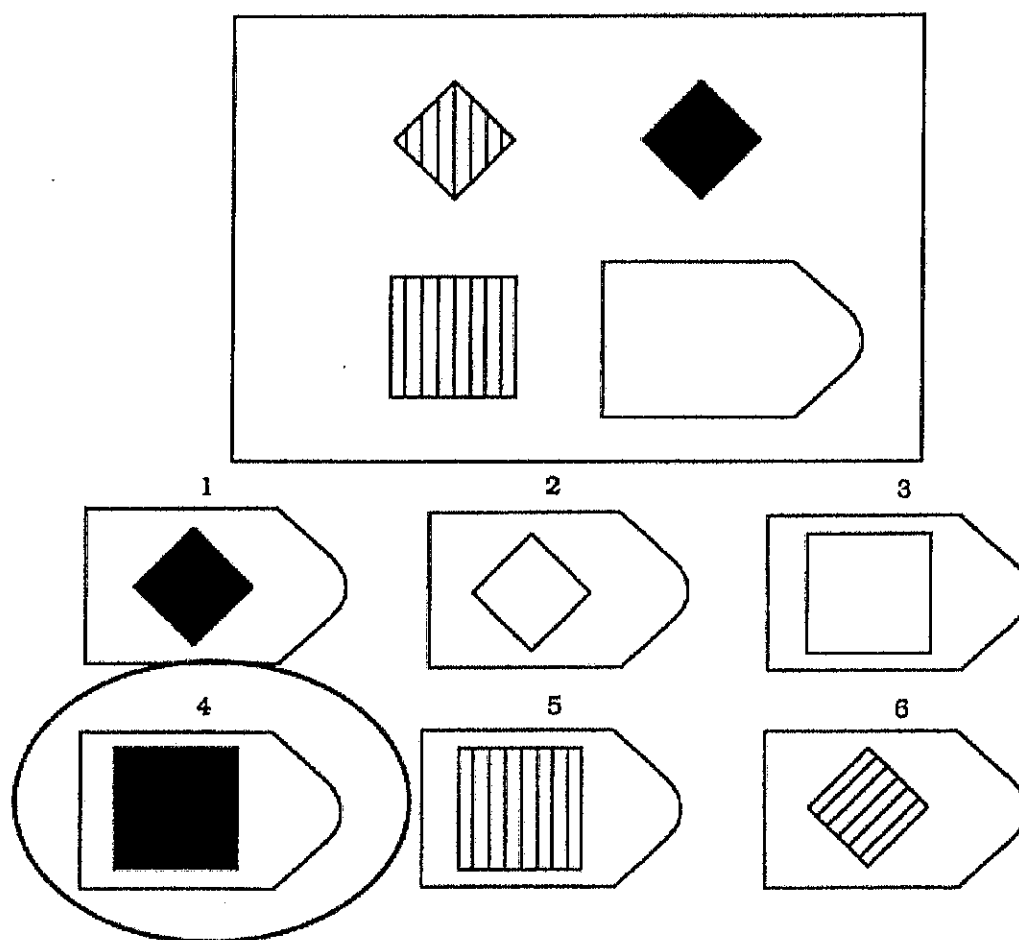
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

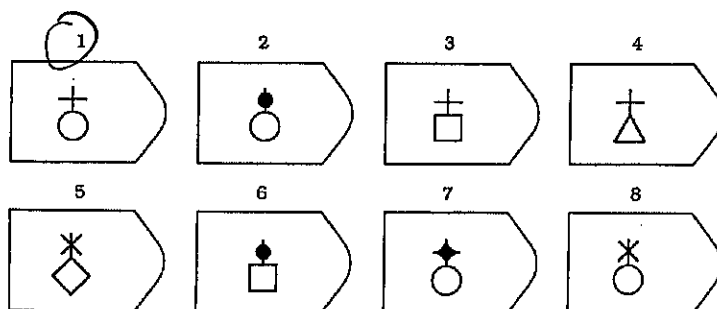
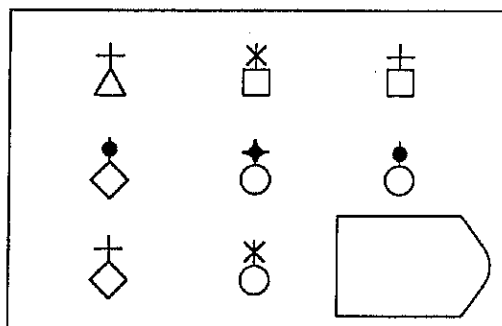


**Answer: 4**

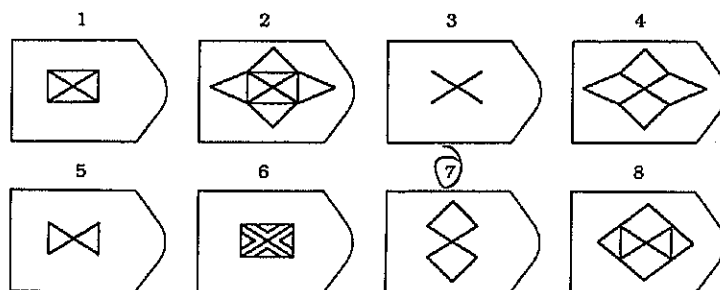
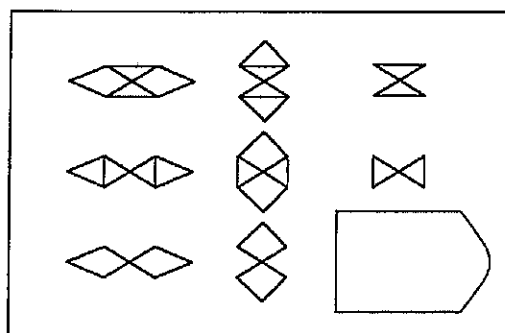
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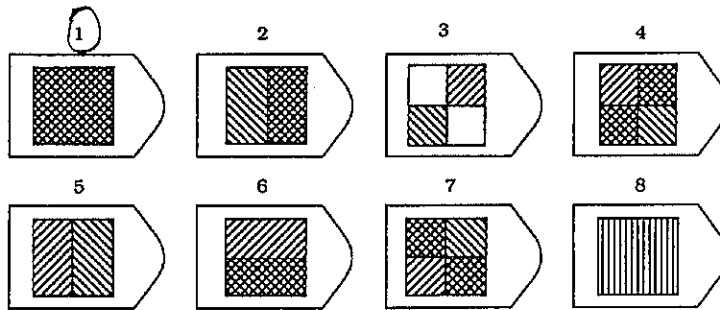
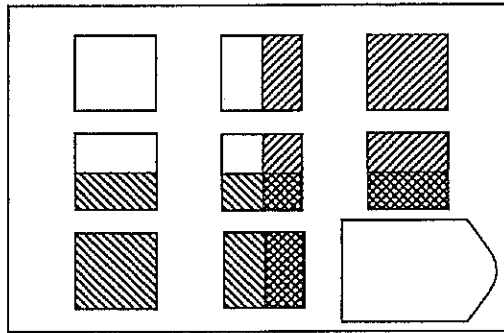
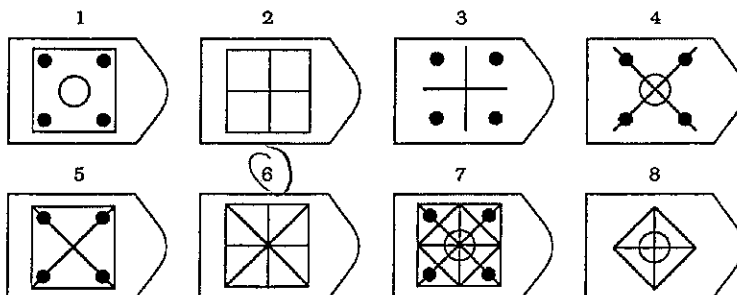
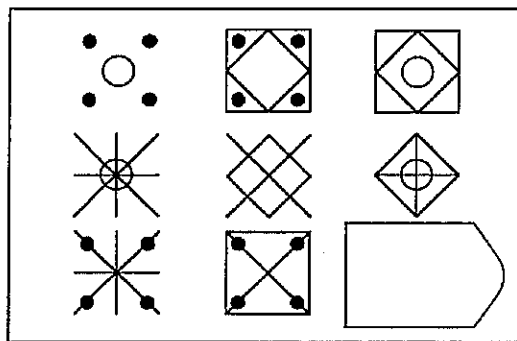
Please choose the image that best completes each of the following patterns.

### PATTERN 1

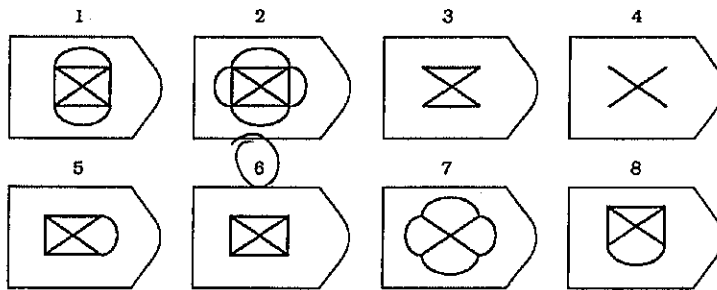
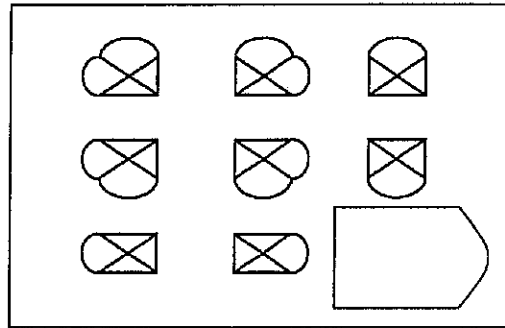


### PATTERN 2



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - ☒ C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - ☒ B. Getting pink eye. They are similar because they are both contagious.
  - ~~C. Getting the flu. They are similar because they are both caused by not washing your hands.~~
  - ~~D. Forgetting to do your homework. They are similar because they are both preventable.~~
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 49426

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☒ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other



STUDENT NAME: A 40680269  
Version B

GROUP: C9

97

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- ~~a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed.~~
  - ~~b. Melting of permafrost resulting in more methane escaping into the atmosphere.~~
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ~~d. An increase in desert formation resulting in more dusting blowing into the atmosphere~~

2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ~~a. The magma becoming colder~~
  - ☒ b. Gas bubbles forming in the magma
  - ~~c. The surrounding crust becoming hotter~~
  - ~~d. Crystals forming in the magma~~

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- ~~a. A= erosion, B= deposition, C= uplift and erosion~~
- ~~b. A= erosion, B= biochemical precipitation, C= uplift and deposition~~
- ~~c. A= dissolution, B= biochemical precipitation, C= uplift and erosion~~
- ☒ d. A= dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ~~a. Human activities are the primary cause of the greenhouse effect.~~
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - ~~c. Human activities and natural processes are roughly equal causes of the greenhouse effect.~~
  - ~~d. Neither human activities nor natural processes are important causes of the greenhouse effect.~~
  - ~~e. The human and natural causes of the greenhouse effect are not understood.~~

5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ~~a. Reservoir A has a shorter residence time than Reservoir B.~~
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - ~~c. Reservoir A and Reservoir B have equal residence times.~~
  - ~~d. More information about Reservoir A and Reservoir B is needed.~~

6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ~~b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.~~
  - ~~c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.~~

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- B
- a. ~~The reservoir will eventually disappear.~~
  - b. The reservoir is not in equilibrium.
  - c. ~~The reservoir is growing smaller.~~
  - d. ~~The reservoir's residence time is 10 years.~~
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- C
- a. ~~The Earth's atmosphere would become colder than it is today.~~
  - b. ~~The Earth's atmosphere would become warmer than it is today.~~
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. ~~The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.~~
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

A46686269

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is the process of earth's oceans becoming more acidic as they absorb more  $\text{CO}_2$ . Colder ocean water can absorb more  $\text{CO}_2$  than warmer water. An increase in atmospheric  $\text{CO}_2$  would increase the atmospheric temperature and also increase the oceans temperature because  $\text{CO}_2$  is a greenhouse gas & when more greenhouse gases are added to the atmosphere the greenhouse effect increases. So initially there would be a positive feedback loop in the oceans - the increase in atmospheric  $\text{CO}_2$  would cause an increase in  $\text{CO}_2$  in the oceans causing an increase in ocean acidification. However as the  $\text{CO}_2$  causes the atmosphere & oceans to warm the oceans would absorb less  $\text{CO}_2$  so the acidity of the oceans would stop increasing & would likely decrease which is a negative feedback. Ocean acidification is affected by the carbon cycle as more  $\text{CO}_2$  moves through the carbon cycle more ends up in the oceans which causes them to absorb more  $\text{CO}_2$  & become more acidic but other factors such as temperature also affect ocean acidification.

AY0680269

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

25

The greenhouse effect is the trapping of infrared or heat in the Earth's atmosphere. It happens as the sun emits visible light/radiation to the earth. This radiation is either reflected from the earth back into space or absorbed into Earth's surface & re-emitted as infrared or heat energy. This is either lost to space or absorbed by greenhouse gases which become excited & then re-emits the energy in all directions some of which is absorbed at earth's surface & then re-emitted & then absorbed & re-emitted by greenhouse gases. The cycle continues which is how earth traps heat in the atmosphere. So if volcanoes erupt large ash clouds this will block the sun's energy from entering the atmosphere which will slow down or lessen the greenhouse effect. This would likely lead to Earth's atmospheric temperature decrease because the earth would not be absorbing & re-emitting as much heat energy so the greenhouse effect would be lessened. When the ash settles the atmospheric temperatures will likely increase because more of the sun's energy will be let into the atmosphere & more will be absorbed & re-emitted. So it will decrease earth's temperature initially but as it settles out earth's temp will increase from before then.

Extra credit (2 points). How are evaporation and degassing similar and/or different?

They are both a substance  $H_2O + CO_2$  leaving a liquid state to the atmosphere. However  $CO_2$  is a gas in water state.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

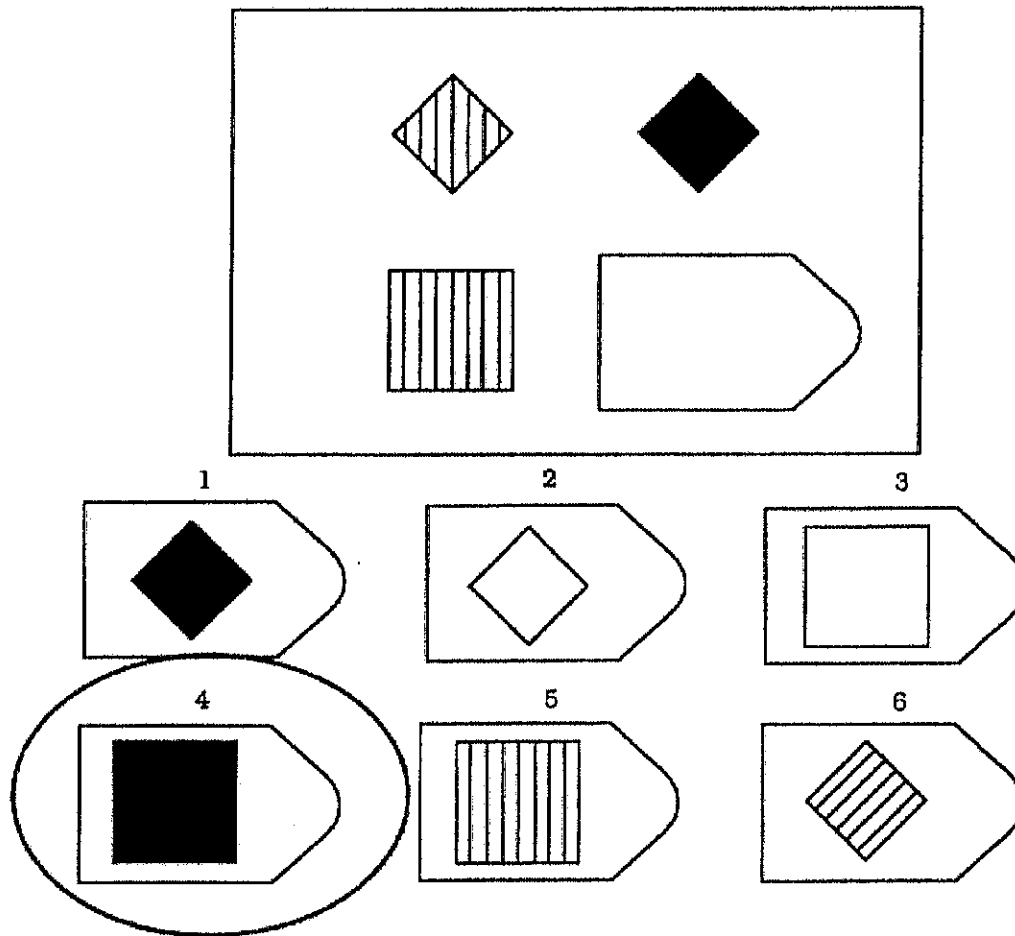
A40680269



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



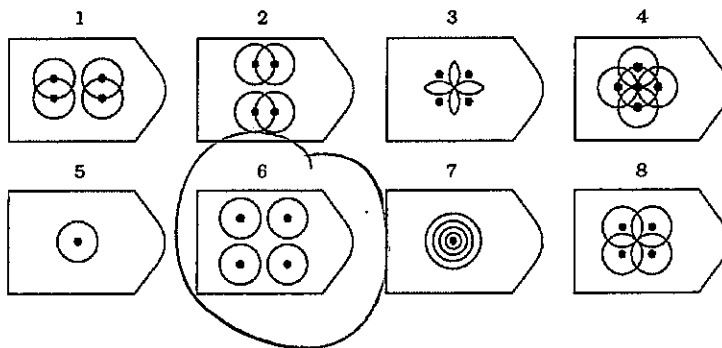
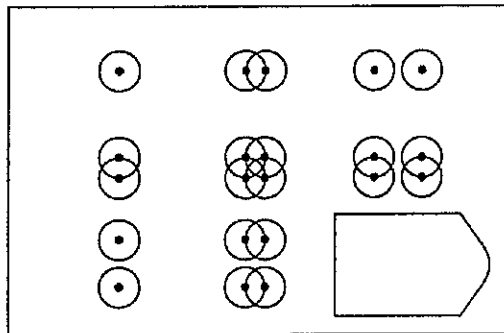
**Answer: 4**

PLEASE CONTINUE ON NEXT PAGE

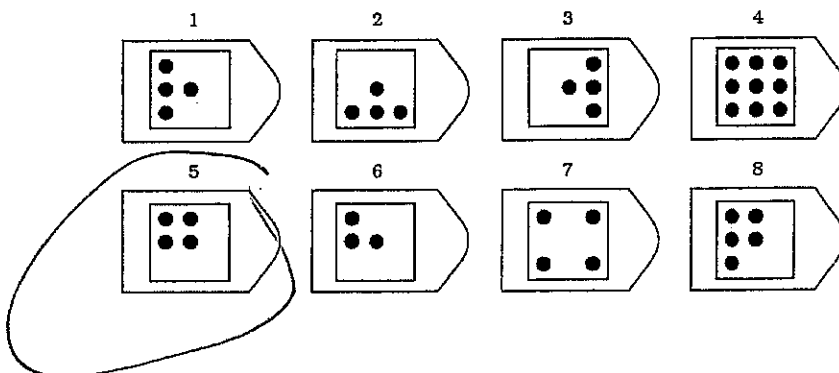
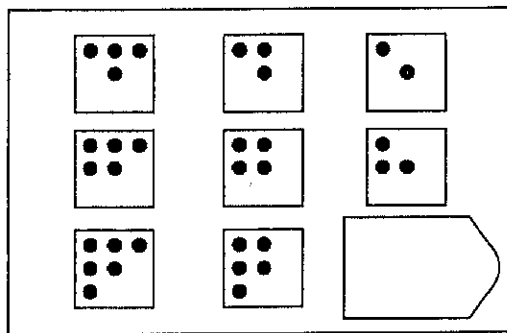
A40686269

Please choose the image that best completes each of the following patterns.

### PATTERN 1



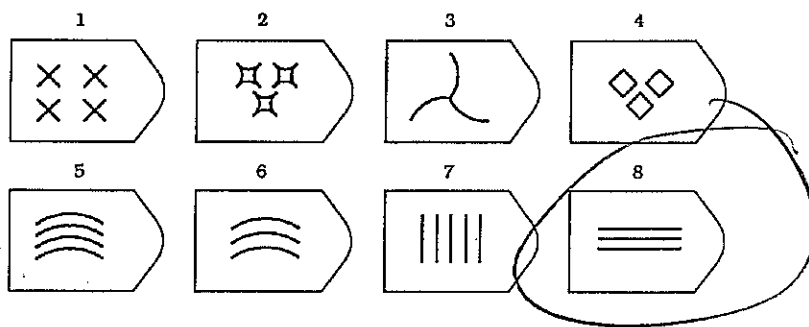
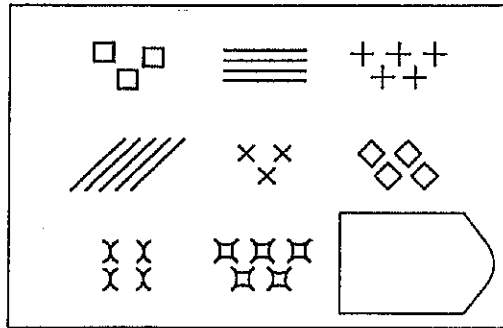
### PATTERN 2



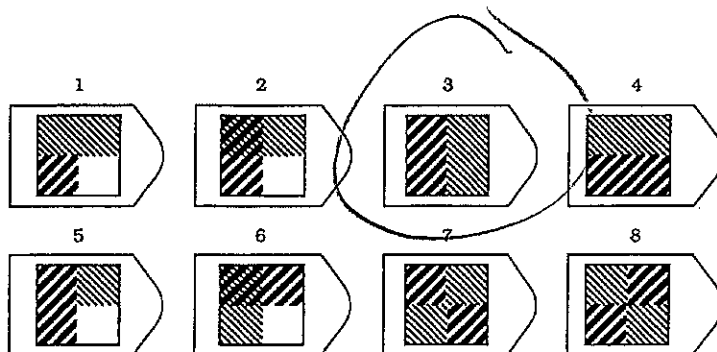
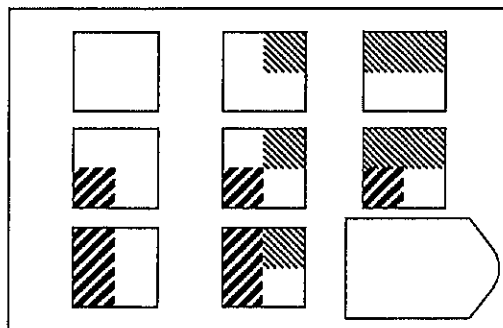
PLEASE CONTINUE ON NEXT PAGE

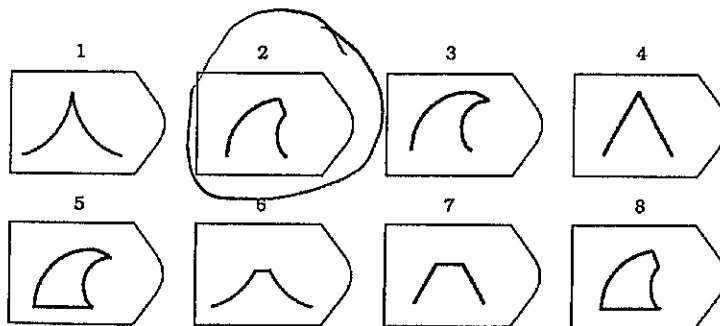
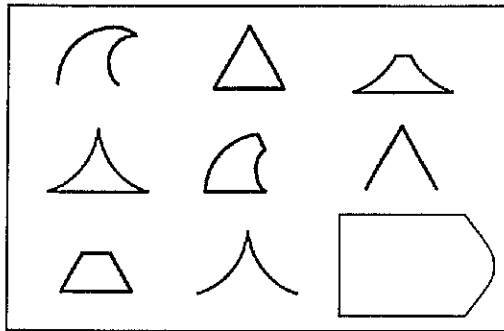


## PATTERN 3



## PATTERN 4



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

~~A. While debugging their broken firewall, a programmer came across top-secret CIA files.~~

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

~~B. When the debate went badly, Ann decided to put more time into developing convincing arguments.~~

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

A40080269

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - ☒ C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

### DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48879

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☒ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 43334997

GROUP: C9

Version B

90

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- ☒ 1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ An increase in evaporation and cloud formation resulting in the release of latent heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
- ☐ 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
- ☐ 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A= erosion, B= deposition, C= uplift and erosion
  - A= erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - A= dissolution, B= deposition, C= uplift and deposition
- ☐ 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - ☒ Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
- ☐ 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
- ☒ 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

A43334997

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

- B7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ☐ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.
- D8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☐ a. The Earth's atmosphere would become colder than it is today.
  - ☐ b. The Earth's atmosphere would become warmer than it is today.
  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- A9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- B10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would increase ocean acidification. More atmospheric carbon dioxide means there will be more carbon dioxide in the oceans. The carbon dioxide in the oceans reacts with the water to form hydrogen, which leads to increased pH levels (acidification). to maintain equilibrium.

- Increase in  $\text{CO}_2$  in the atmosphere  $\rightarrow$  atmosphere warmer  $\rightarrow$   $\text{CO}_2$  in oceans increases  $\rightarrow$  ocean acidification increases. Positive feedback
- Increase in  $\text{CO}_2$  in atmosphere  $\rightarrow$  atmosphere warmer  $\rightarrow$  ocean becomes warmer  $\rightarrow$  less  $\text{CO}_2$  in the ocean — less acidification. Negative feedback

25

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect is the process by which the sun emits light energy, solar radiation, that is either absorbed by the Earth or reflected back off of the Earth by glaciers. If it is absorbed by the Earth then the energy is transferred from light to infrared and shot back out into the atmosphere. This infrared energy gets absorbed and bounces back into the atmosphere by greenhouse gasses, so in a sense the heat is 'trapped' in the atmosphere. Some of the energy slips by the greenhouse gasses and is put into space, this is what keeps the Earth from being too hot. If volcanism on Earth suddenly increased dramatically, causing there to be large ash clouds there would be global cooling at first. The large ash clouds would block solar radiation from the sun to get into the atmosphere, and large amounts of CO<sub>2</sub> would be trapped in the atmosphere. Once the ash clouds left the atmosphere there would be global warming because of the solar radiation entering the atmosphere, become infrared energy and reacting with the large amounts of CO<sub>2</sub> still in the atmosphere from the volcanoes.

25

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation = water going from liquid to gas in atmosphere.

degassing = carbon being released from biosphere to atmosphere.

Both being put in atmosphere  
Evap = water  
degassing = carbon



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

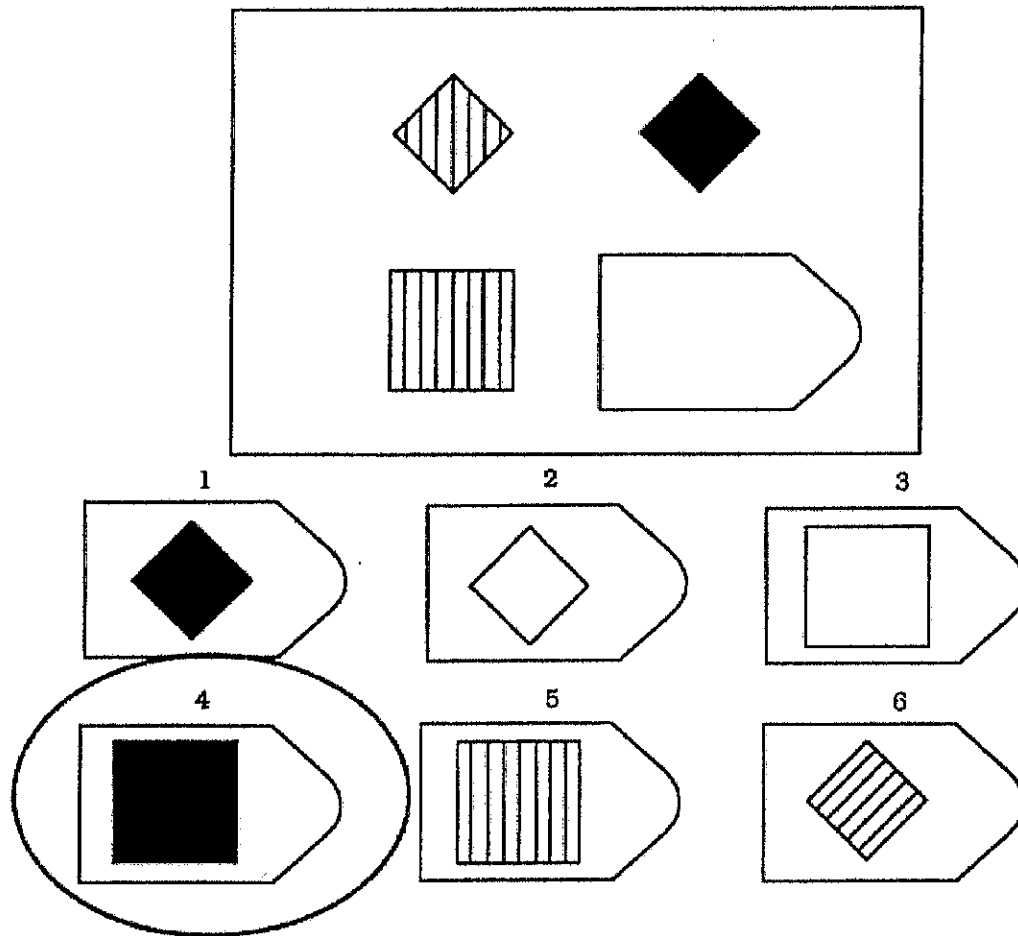
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

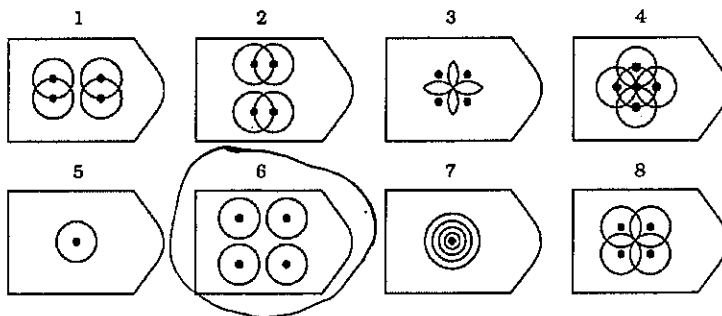
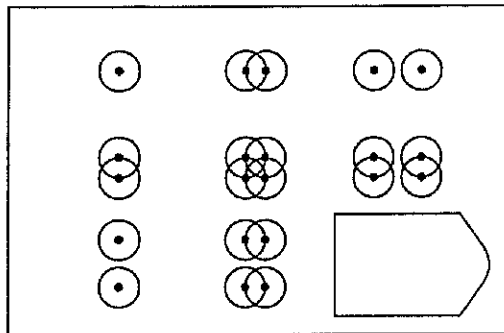


**Answer: 4**

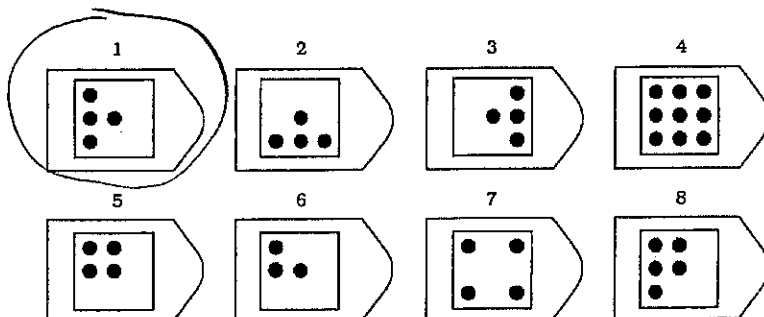
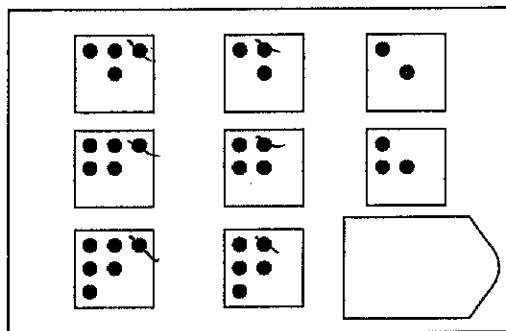
PLEASE CONTINUE ON NEXT PAGE

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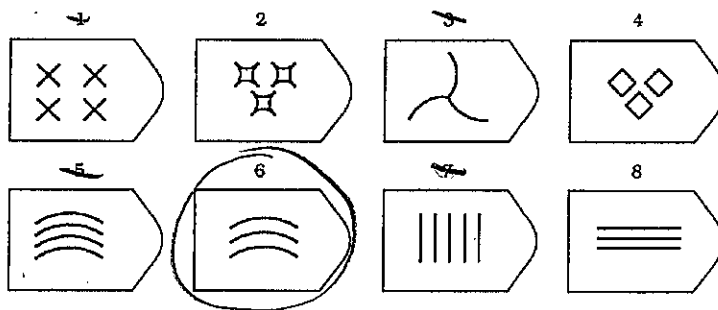
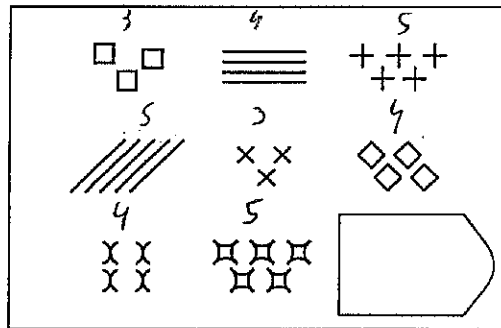
### PATTERN 1



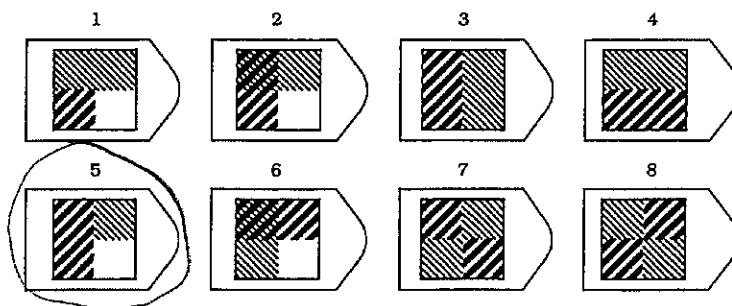
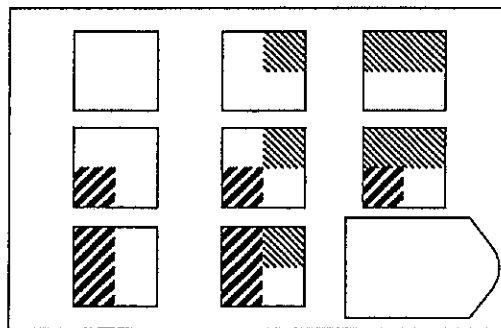
### PATTERN 2



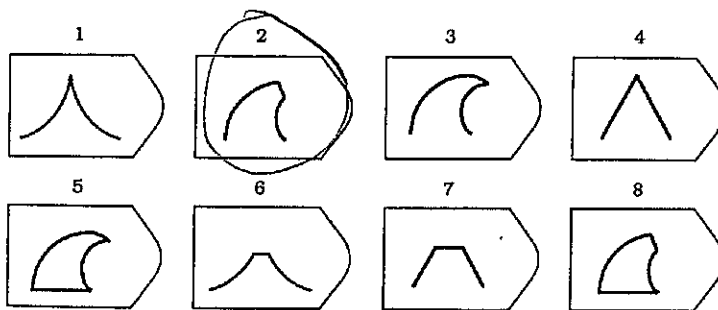
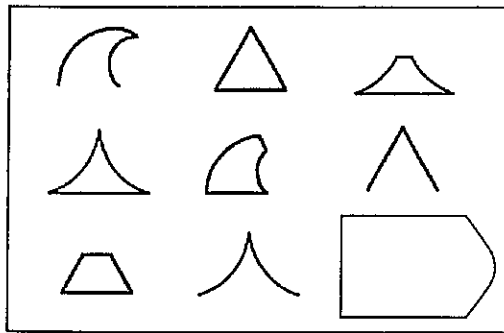
## PATTERN 3



## PATTERN 4



## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

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2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
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- ☐ C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- ☐ D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

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- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

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PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

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- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☐ A. Getting high. They are both involve too much of a chemical influencing the body.
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2. Water freezing is like...

- ☐ A. Dew forming. They are similar because they both involve a drop in temperature.
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- ☐ C. Clouds forming. They are similar because they both involve a phase change.
- ☐ D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48360

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A41650757  
Version B

GROUP: C9

$1K \downarrow = \text{heat absorbed} \uparrow = \text{CO}_2 \text{ temp} \uparrow$

79

MULTIPLE-CHOICE. 5 points each (50 points total).

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
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5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

$\text{CO}_2 \uparrow = \text{temp} \uparrow = \text{less CO}_2 \text{ dissolved}$

$$\begin{array}{l} A \quad 2x \quad B \\ \frac{1000}{100} = 10 \quad \frac{500}{100} = 5 \end{array}$$

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.  
b. The reservoir is not in equilibrium.  
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8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.  
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d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
b. Reflection of more solar radiation, causing atmospheric temperature to increase  
c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

temp ↑ = evap ↑ = ↑ clouds = energy released ↑ = temp ↑

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25 A. Ocean acidification is effected by the amount of  $\text{CO}_2$  going into the hydrosphere. The  $\text{CO}_2$  leaving the atmosphere and going into the oceans bonds with the hydrogen atoms to produce  $\text{HCO}_3^-$ . An increase of atmospheric  $\text{CO}_2$  would mean an increase in  $\text{CO}_2$  going into the oceans would occur. Unless the global temperature goes up causing the hydrosphere temperature to increase by the atmospheric  $\text{CO}_2$  increase, the water will absorb the  $\text{CO}_2$ . Colder waters can absorb more gases than warm water can. So if the ocean temperature increases than warmer waters will absorb less  $\text{CO}_2$ . The increase of atmospheric  $\text{CO}_2$  leading to an increase of  $\text{CO}_2$  absorbed and dissolved by hydrogen atoms in the water will make its acidity decrease. This is a negative feedback loop because it's increasing the amount of  $\text{CO}_2$  but not as much as it would if the atmospheric temperature increased with the  $\text{CO}_2$  increase.

If the atmospheric  $\text{CO}_2$  increases leads to an increase in temperature which it usually does then the ocean waters will heat making it more difficult to absorb gases and leaving more  $\text{CO}_2$  in the atmosphere. Then the ocean acidification would decrease <sup>because</sup> of its inability to absorb  $\text{CO}_2$ . This would be a positive feedback loop because the increased  $\text{CO}_2$  in the atmosphere is still increasing as it goes through the processes leading up to more increase in  $\text{CO}_2$ .

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

24 A. The Earth's surface of water and soils absorb incoming solar radiation from the Sun. The Earth's ice sheets and glaciers reflect the Sun's radiation <sup>back into the atmosphere.</sup> The radiation absorbed is transferred into thermal radiation/heat by processes such as respiration by plants that will give off heat. The thermal radiation is then re-emitted back into the atmosphere where the Earth's naturally occurring greenhouse gases (that cannot absorb the sun's natural radiation's initial break through until it's converted) absorb the heat and trap it in the atmosphere but some heat does escape back into space. The heat is again radiated back to the surface and ice sheets/glaciers continuously either re-absorbing or re-emitting. This effect traps heat and with the more greenhouse gases than natural amount in the atmosphere the more the thermal heat is trapped in our atmosphere. In turn this will increase atmospheric temperature.

B. volcanoes erupting and creating large ash clouds will have an effect on atmospheric temperature. The ash clouds will block and decrease the normal amount of sun radiation coming thru the atmosphere. This would decrease the atmospheric temperature because less radiation would make it to the surface to be re-emitted and trapped as heat by the greenhouse gases. Temperature decrease would decrease the rate of evaporation. This would mean less  $\text{CO}_2$  would be evaporated into the atmosphere until the ash clouds fall back down to the surface. Also the decrease in atmospheric temperature would mean the hydrosphere/ocean water temperature's will decrease making the colder waters that can absorb more gases in return more  $\text{CO}_2$  would be dissolved into the waters; making the atmosphere colder.

~~Extra credit (2 points).~~

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

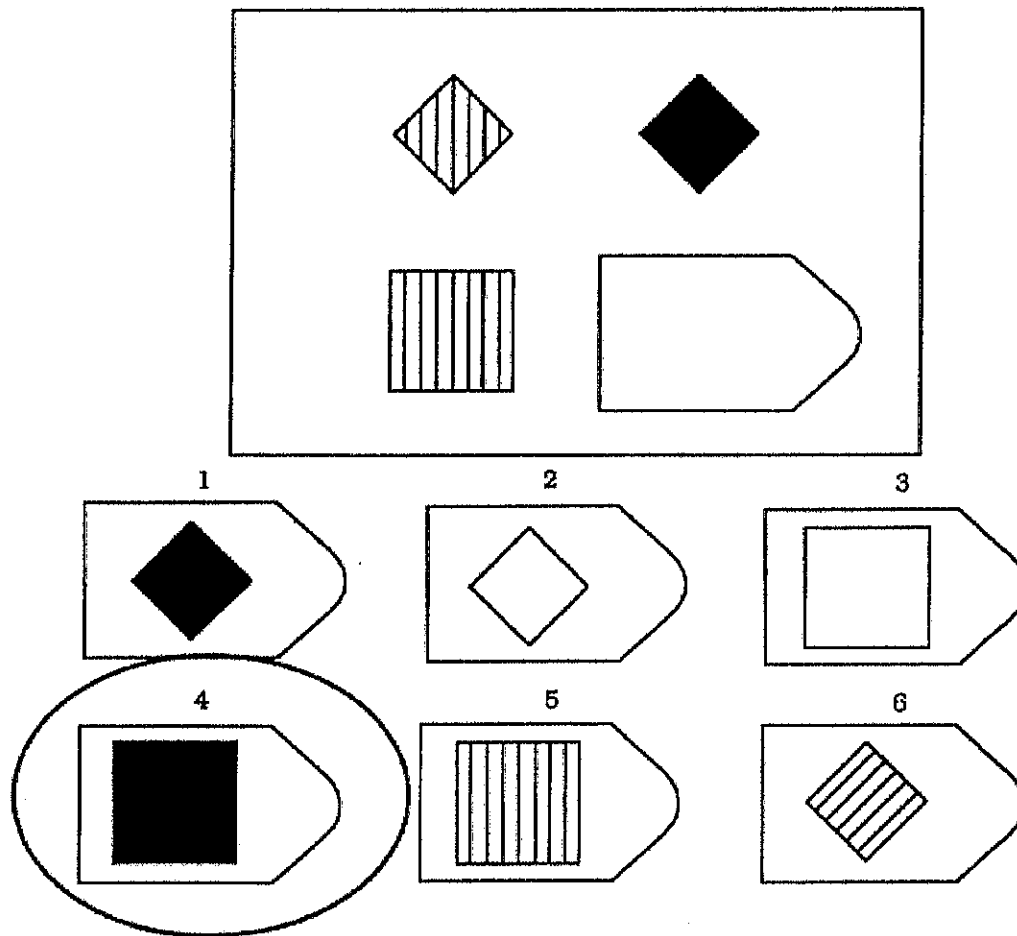


# Analogical Assessment

---

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*Example*

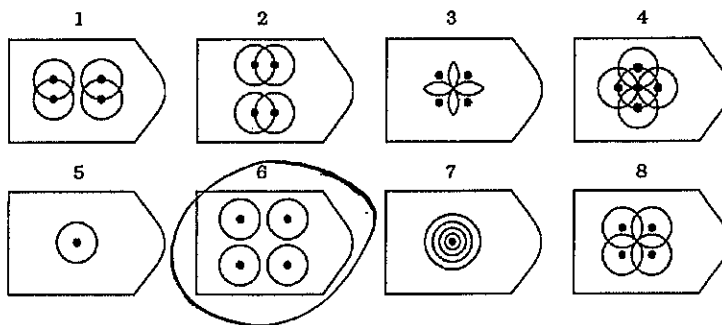
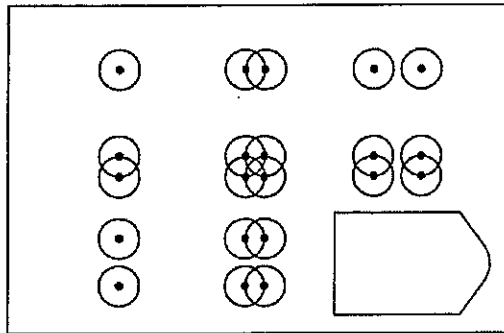


Answer: 4

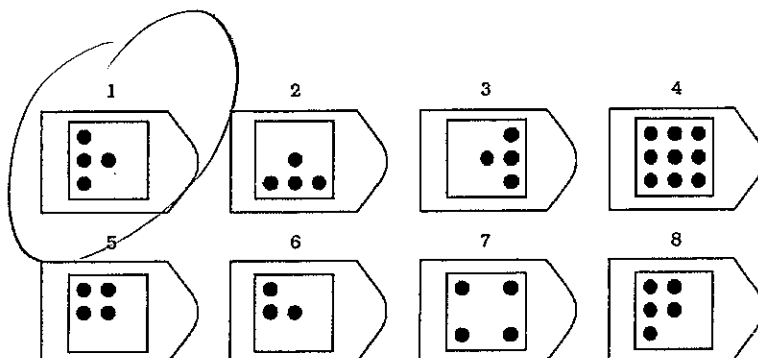
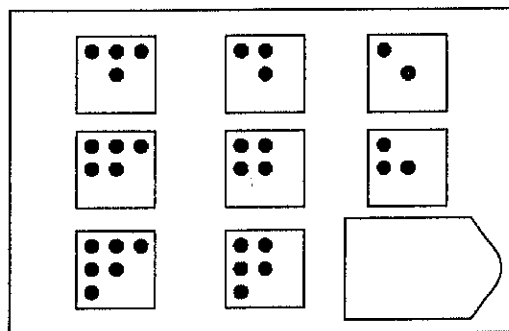
PLEASE CONTINUE ON NEXT PAGE

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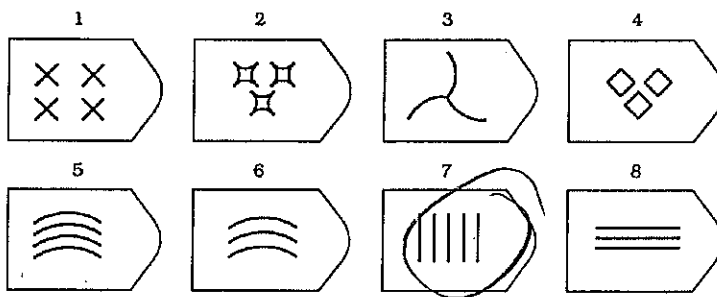
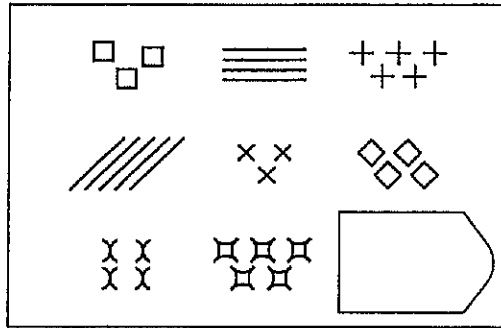
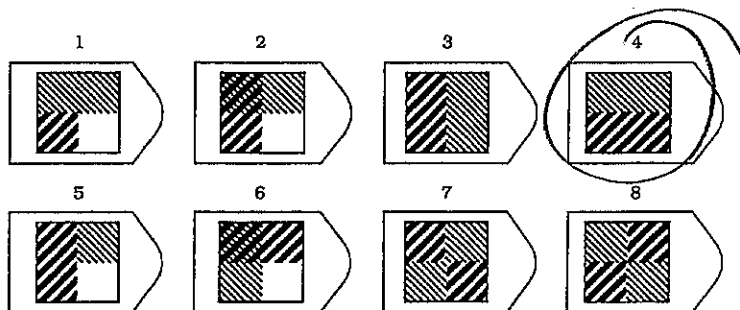
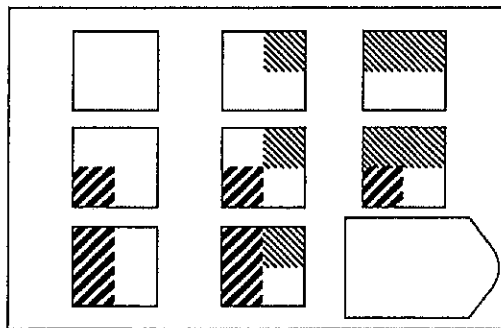


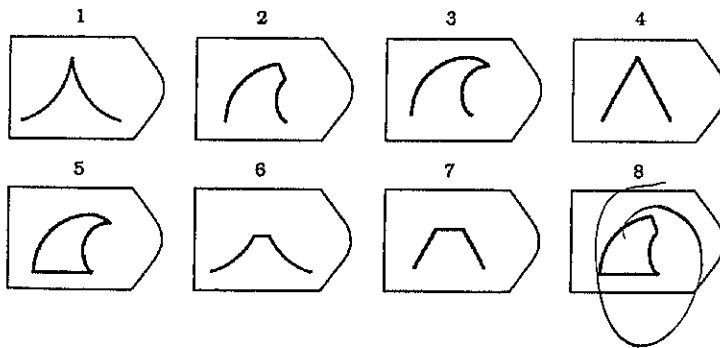
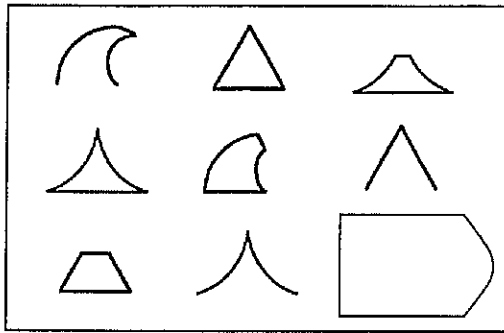
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PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

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- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
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- D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

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- C. Once he saw everyone else's formal suits, Dan went home to change clothes.
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PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
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  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
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- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

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- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 98340

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

~~Study~~ *Attended study session before 1 exam*

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A40786055  
Version B

GROUP: C9

83

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ An increase in evaporation and cloud formation resulting in the release of ~~latent~~ heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion
  - ~~A = erosion, B = biochemical precipitation, C = uplift and deposition~~
  - ☒ A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - ~~A = dissolution, B = deposition, C = uplift and deposition~~
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - ☒ Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
- 2B = B  
-5 -5*
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- warm water holds less CO<sub>2</sub> than cold water*  
*atmosphere ↓ Oceans ↓*

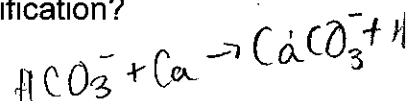
7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ☐ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☐ a. The Earth's atmosphere would become colder than it is today.
  - ☐ b. The Earth's atmosphere would become warmer than it is today.
  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease.
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase.
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase.
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease.
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.



Ocean acidification is the process where gaseous  $\text{CO}_2$  enters the ocean and combines with water to form  $\text{HCO}_3^-$  and  $\text{H}^+$  ions. The  $\text{HCO}_3^-$  ions increase the acidity of the water and combine with calcium to help sea creatures such as mollusks build shells and structures.

The increase of  $\text{CO}_2$  in the atmosphere would directly increase the amount of  $\text{CO}_2$  in the oceans, thus lowering the pH of the ocean water and increase the acidity of the oceans.

A positive feedback loop associated with ocean acidification would be the increase in temperature. The greenhouse effect warms the earth when greenhouse gases re-emit heat. When the atmosphere gets warmer, the oceans get warmer. This leads to an increase in oceanic evaporation, which puts more  $\text{CO}_2^{(\text{gas})}$  into the air, thus encouraging the increase of atmospheric carbon. X

A negative feedback loop would encourage equilibrium of a reservoir. So, if there is more  $\text{CO}_2$  in the atmosphere, Earth's systems will try to balance the influx by increasing the outflux. This would mean that the increased more  $\text{CO}_2$  that is released into the atmosphere <sup>by people</sup>, the more  $\text{CO}_2$  will go into the oceans and leave the reservoir. This maintains that there is a more consistent <sup>atmospheric</sup> amount of  $\text{CO}_2$  in the atmosphere, inhibiting dramatic change in the atmosphere.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

When more volcanoes erupt, they release ash into the atmosphere. This volcanic ash sits at the top of the atmosphere and prevents visible radiation from "making it" to Earth's surface.

Usually, visible light from the sun will go through the atmosphere, hit Earth's surface, and then be reflected as infrared light and heat. Greenhouse gases (water vapor,  $\text{CO}_2$ ,  $\text{CH}_4$ ) will absorb this IR light, become excited, and then re-emit it back onto the surface of Earth, thus "trapping" the IR light and allowing the surface to absorb and radiate more heat.

Because volcanoes are preventing this from occurring, there is less visible light to be turned into heat, and therefore the temperature would decrease in the atmosphere.

23

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation involves a state change, while degassing involves a gas staying in its state.  
(Liquid to gas)

They are similar because they both involve gases moving between reservoirs



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

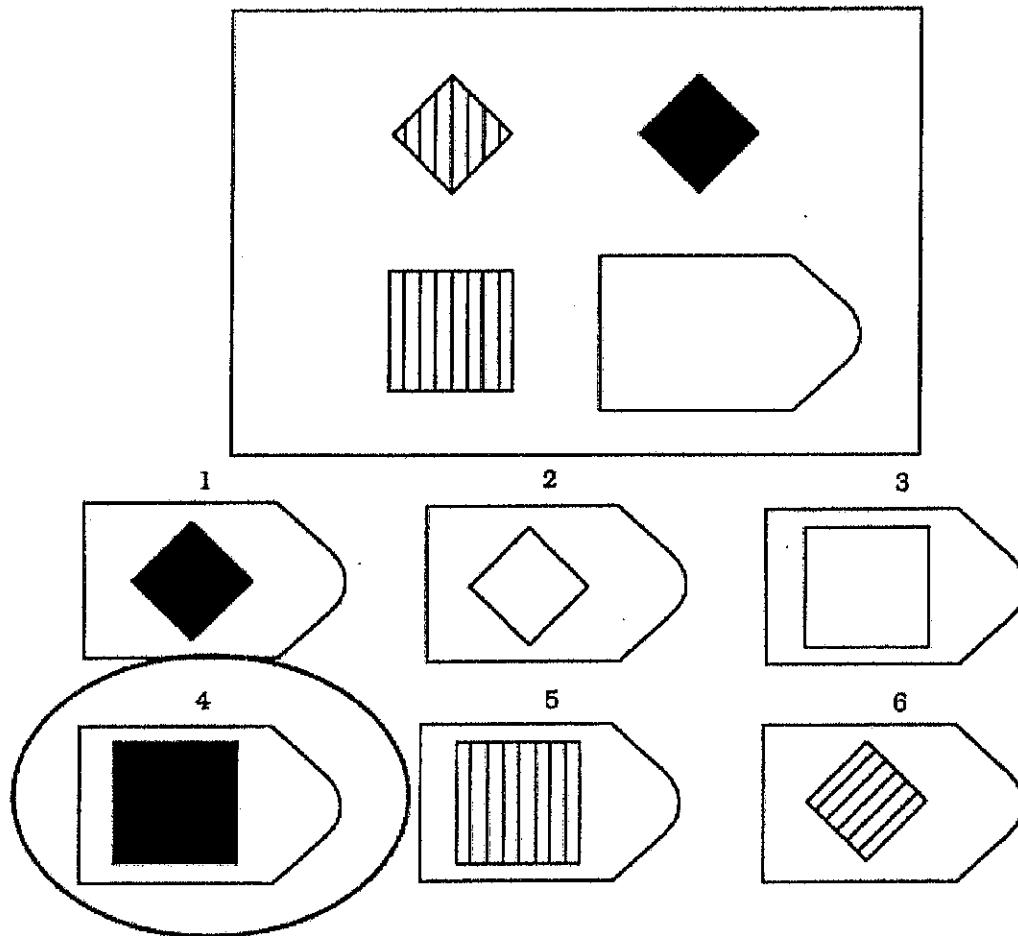
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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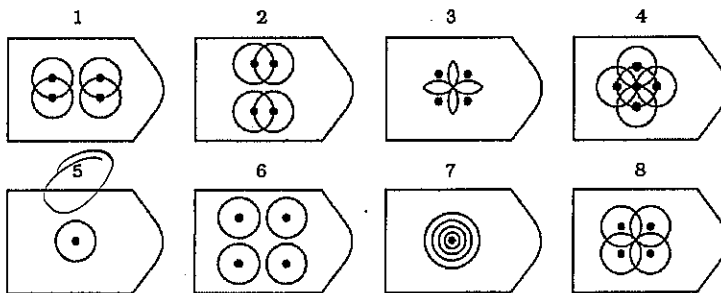
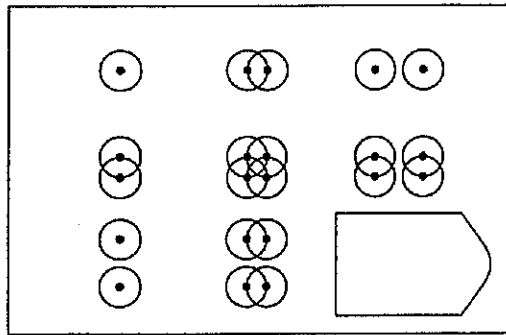


**Answer: 4**

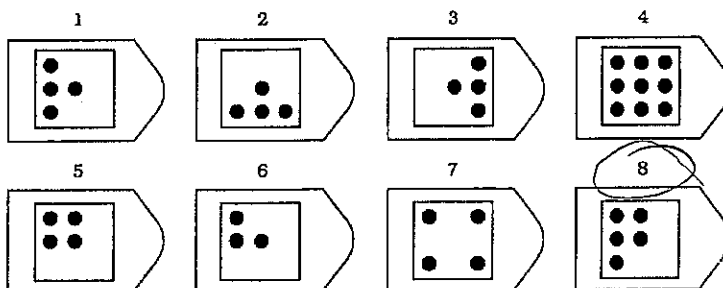
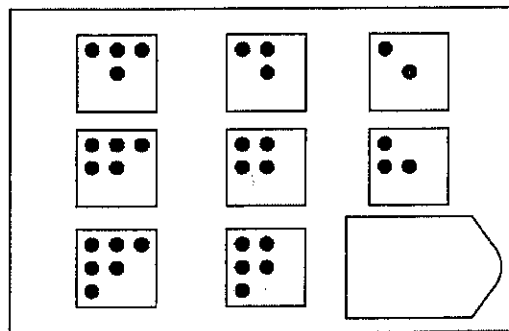
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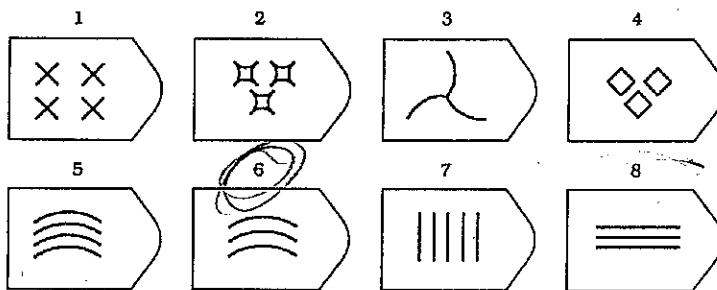
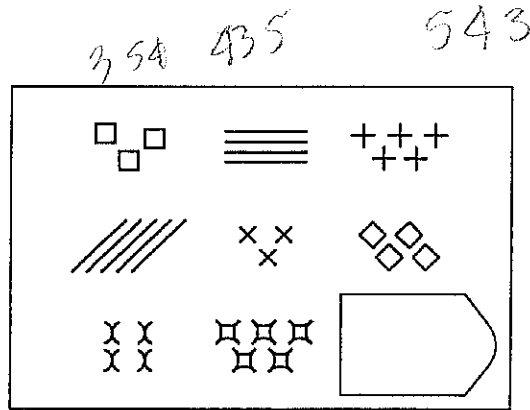
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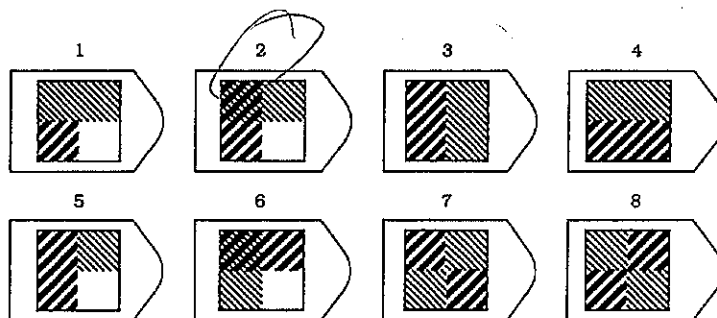
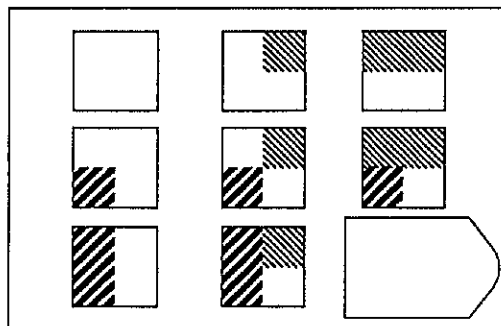
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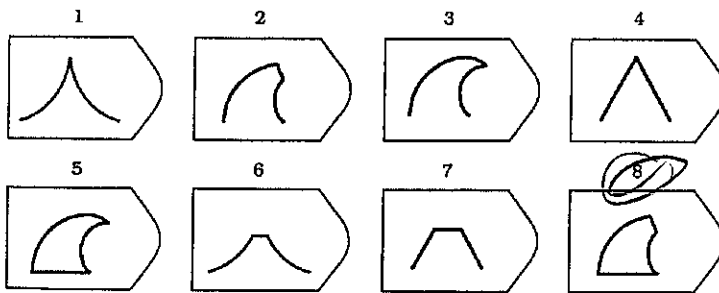
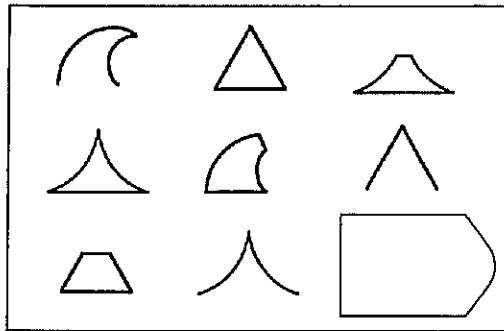


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## PATTERN 4



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## DEMOGRAPHICS

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☐ Transgender

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☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other



STUDENT NAME: A403060  
Version A

GROUP: C10

71

**MULTIPLE-CHOICE. 5 points each (50 points total).**

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  - ☒ b. Gas bubbles forming in the magma B
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  - ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition B
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  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
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  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
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6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
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**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
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- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
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SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase of atmospheric carbon dioxide would then cause the temperature to rise. The increase would then cause the oceans temperature to also rise making for ~~less~~ carbon dioxide to be dissolved in the ocean. When ocean temperature cools, the water can dissolve  $\text{CO}_2$  at a greater rate which would then cause ocean pH level to rise. The  $\text{CO}_2$  turns into hydrogen which increases the acidity of the oceans. With the increase of temperature there may be more evaporation which could then lead to more precipitation, and with the higher pH levels could then increase weathering since there may be more acidity in the precipitation. Biochemical Solution can also cause the acidity to rise in the ocean.

20

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
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If volcanoes began to emit large ash clouds we could see a decrease of solar radiation, since the ash clouds will not allow the energy to get through, since it visible light doesn't penetrate well. This could then cause an decrease in atmospheric and ocean temperature which will allow more carbon dioxide to dissolve in the ocean, causing the acidity levels in the oceans to rise. The increase of  $\text{CO}_2$  levels would also rise and because of the greenhouse effect, could trap more heat thus causing the temperatures to possibly be less effected by the volcanic ash clouds. Although the ash clouds would cause the temp to decrease because of the prevention of solar energy entering the atmosphere, the greenhouse effect would raise or keep temperatures stable because the heat would be trapped. Greenhouse effect is caused by the energy we receive from the sun. Since most the energy doesn't bind well with molecules it is either reflected back into space, via glaciers etc, or absorbed by the earth's surface. With the greenhouse effect, the greenhouse gases ( $\text{CO}_2$ ) trap the energy into infrared energy which then causes the temperature to increase since the energy is not released or absorbed. +?

20

1 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is when a liquid transforms into a gas, while degassing is when the gas is ~~transferring~~ moving into the air over the sea

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

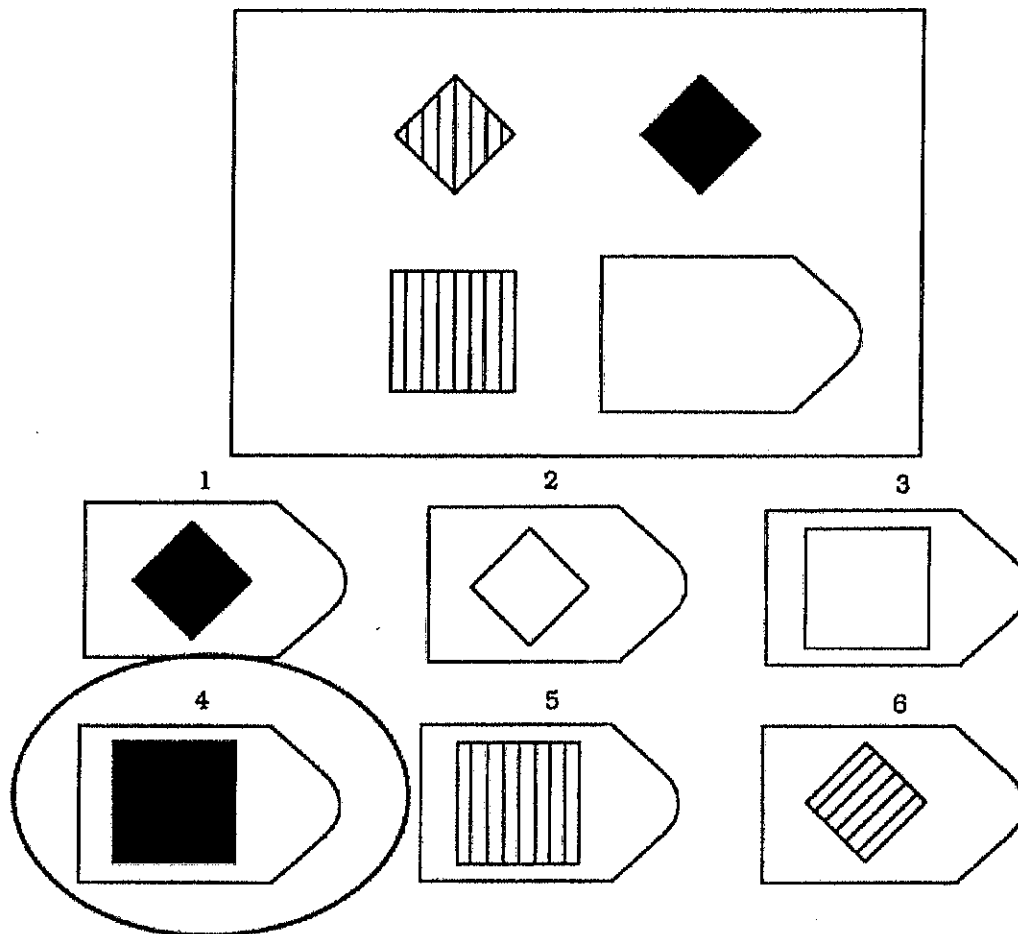
**Thoughtfully complete the attached survey**



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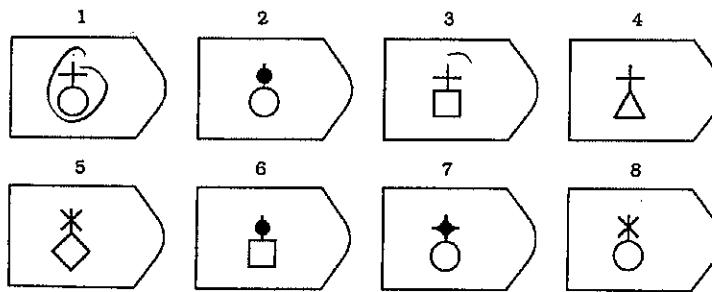
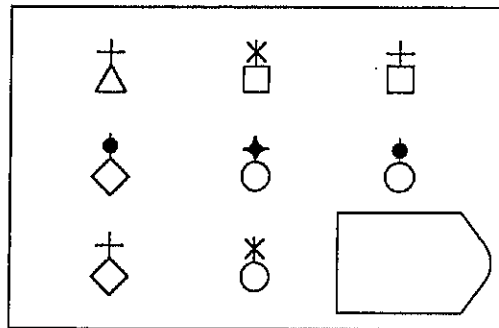


**Answer: 4**

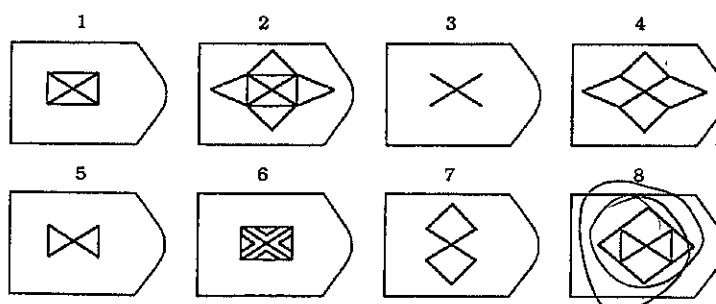
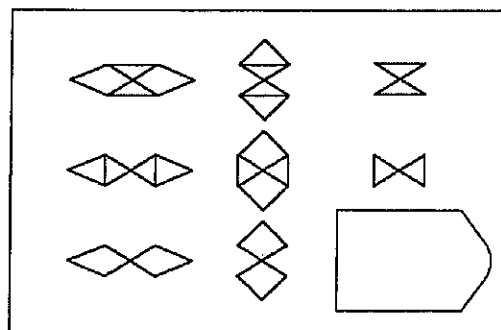
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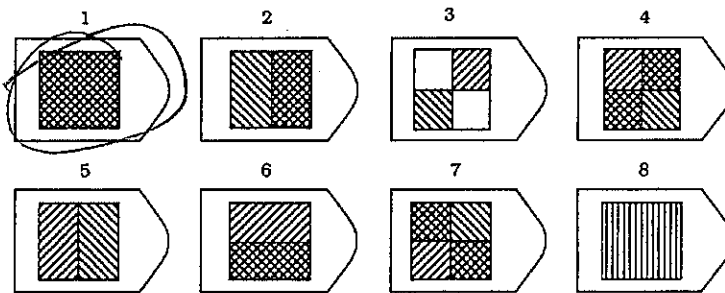
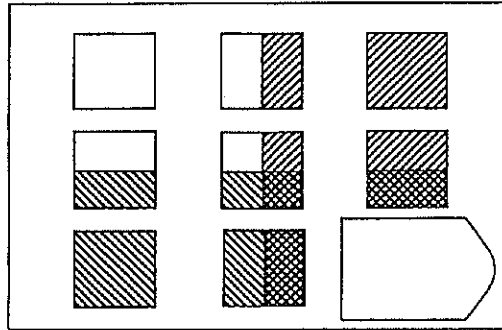
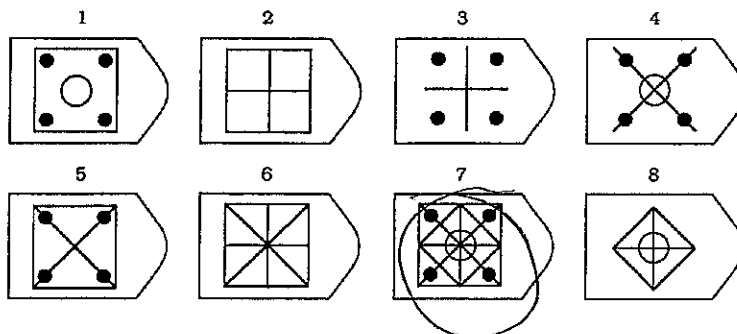
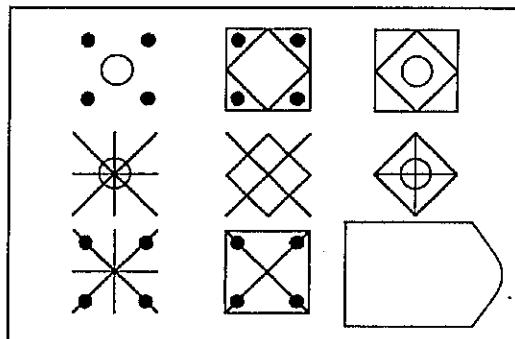


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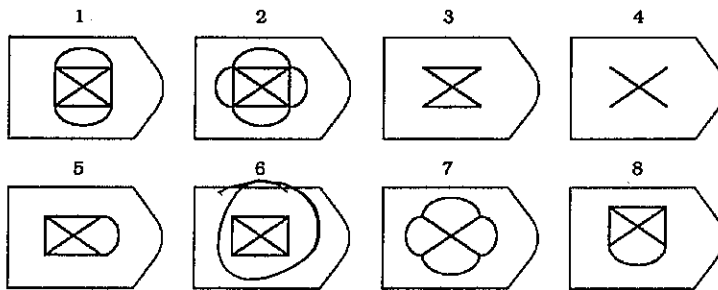
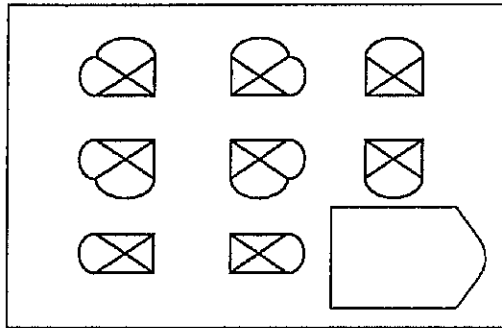


PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

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PLEASE CONTINUE ON NEXT PAGE

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#### DEMOGRAPHICS

What is your age? 23 years

What is your home zip code? 48823

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A42108428  
Version A

GROUP: C10

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
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  - ☒ b. A= erosion, B= biochemical precipitation, C= uplift and deposition
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4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
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**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

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1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

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- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification occurs when pH levels in the waters rise. If there were an increase in atmospheric carbon dioxide ( $\text{CO}_2$ ), this would cause an increase in the oceans carbon levels as well. This could lead to many effects on the oceans acidity levels. With an increase in  $\text{CO}_2$ , ocean temperatures would rise. This will cause a change in the hydrosphere and the matter/substances present in it.

For instance, coral reefs are greatly affected by carbon levels. It has been shown that coral reefs are disappearing because of this. Run off and erosion from higher sea levels (glaciers melting) cause a lot of acidity and problems for the ocean as well. A positive feedback from this would be carbon dioxide warming Earth, melting glaciers, and increasing heat radiation off of the ground the glacier once was on. A negative feedback would be the carbon dioxide increasing ocean acidification, increasing sea levels, but decreasing plants and animal life.

5

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
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If there were an increase in volcanoes and ash clouds, Earth's temperature would change a lot. First, the ash clouds would block the sun, eliminating some radiation it puts out. If the clouds were constantly around for a long period of time, it could cause an abrupt climate change on Earth. Ash clouds from volcanoes include a lot of carbon dioxide as well. Carbon Dioxide is an important greenhouse gas that can eventually greatly affect Earth's climate. In the greenhouse effect, chemicals such as CO<sub>2</sub> and Methane act to block some heat radiation back to Earth's surface. If this were the case, the Earth would eventually get warmer. With this comes oceans rising, and glaciers melting. If the process went on long enough, Earth's climate would change drastically.

5

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is the process of turning a liquid into a gas, while degassing is the process of removing a gas from a substance.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

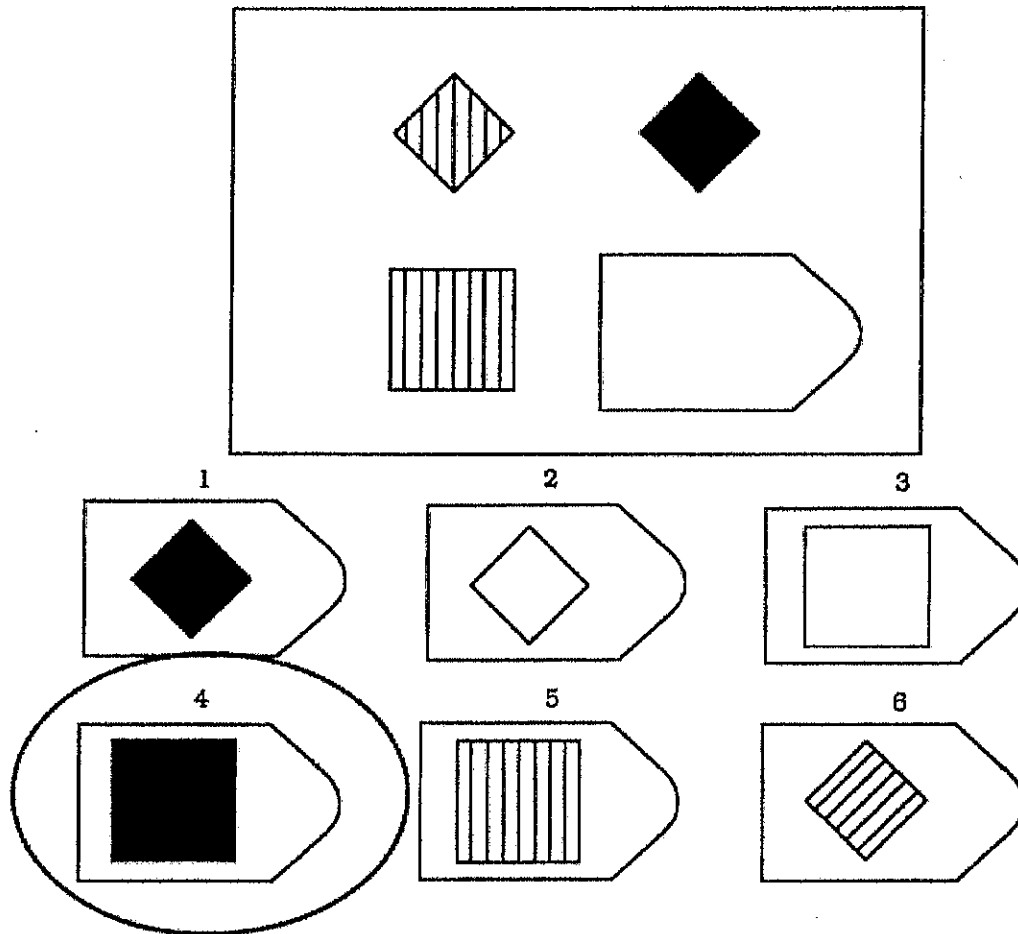
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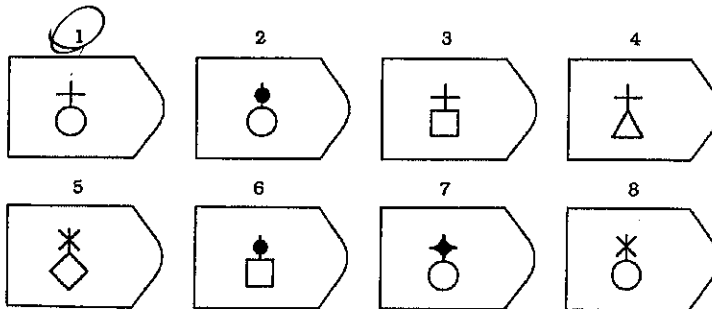
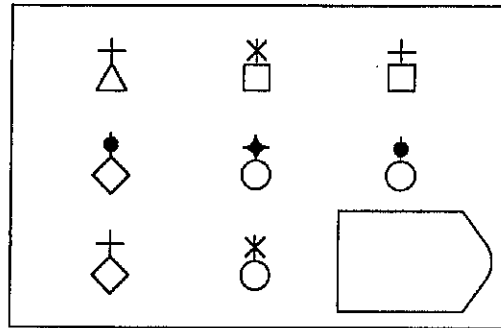


Answer: 4

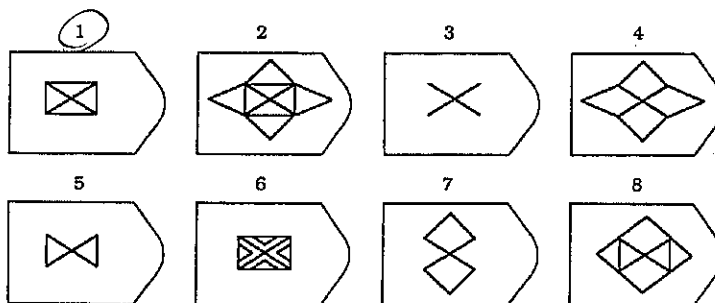
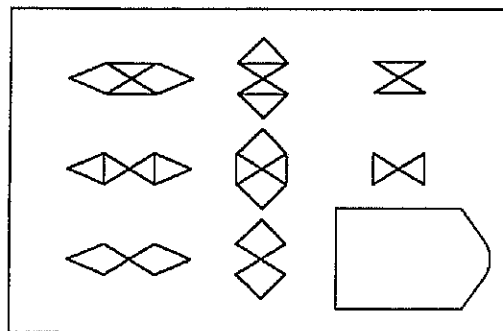
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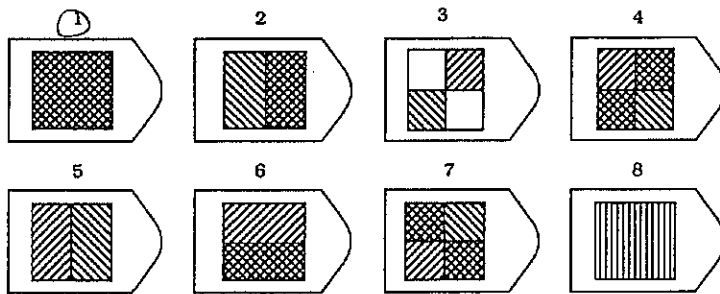
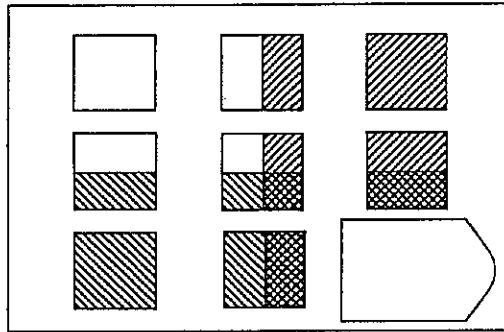


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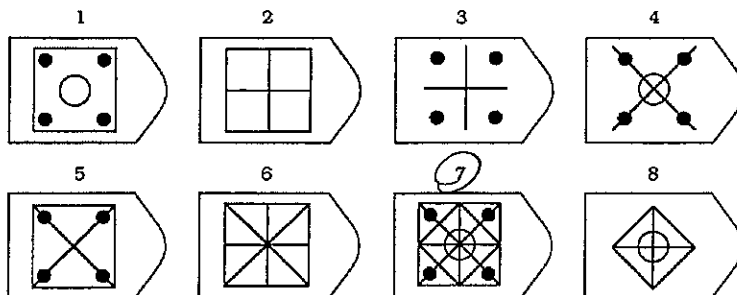
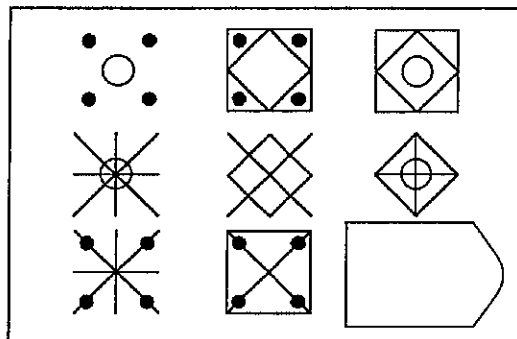


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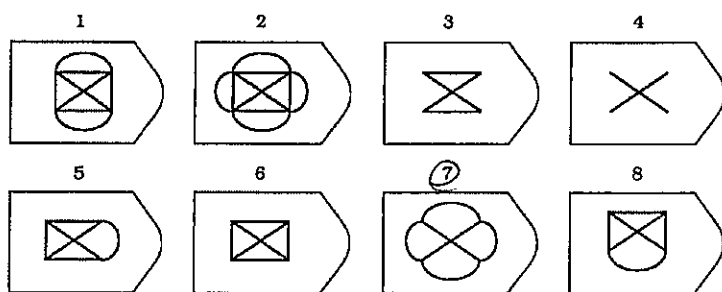
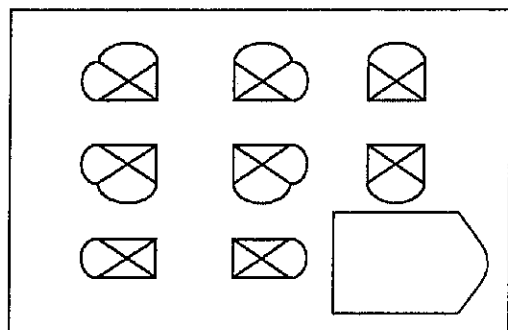
## PATTERN 3



## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

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What is your gender?

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- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
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- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A3916396  
Version A

GROUP: C10

30

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - An increase in evaporation and cloud formation resulting in the release of latent heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A= erosion, B= deposition, C= uplift and erosion
  - A = erosion, B= biochemical precipitation, C= uplift and deposition
  - A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- The reservoir will eventually disappear.
  - The reservoir is not in equilibrium.
  - The reservoir is growing smaller.
  - ☒ The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ Reflection of more solar radiation, causing atmospheric temperature to decrease
  - Reflection of more solar radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☒ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- The Earth's atmosphere would become colder than it is today.
  - The Earth's atmosphere would become warmer than it is today.
  - The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification occurs as carbon dioxide is dissolved into the ocean. This occurs as water ( $\text{H}_2\text{O}$ ) bonds with Carbon dioxide ( $\text{CO}_2$ ) in the atmosphere to form acid rain and other acidic forms of precipitation ( $\text{HCO}_3^- + \text{H}^+$ ). Acidification of the oceans has a negative impact on ocean wildlife that is the foundation of the food chain, such as shellfish and plankton. However, carbon is necessary for life in the ocean. Carbon is deposited into the basic lifeforms and seabed, and is an element vital for survival in the ocean. Ocean acidification occurs more densely in the polar regions due to the lower density of the water which allows for more absorption. An increase in atmospheric carbon dioxide would increase temperature in the atmosphere and the level of carbon absorbed into the oceans, however the end result is unknown, because of the complicated nature of the feedback loops in the carbon cycle, and the size of the oceans, and the seemingly limitless amounts of carbon that could be absorbed.

2

5

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

~~A suddenly~~ A sudden increase in volcanic ash in the earth's atmosphere would lead to a rise and fall in atmospheric temperature. The greenhouse effect is the process of natural elements of carbon, hydrogen, and nitrogen trapping energy from the sun in the form of visible and infrared radiation in the earth's atmosphere. The trapping of the radiation leads to an increase of ~~heat in~~ temperature in the atmosphere. This in turn leads to an increase in evaporation and cloud cover which reflects radiation back into space where the energy escapes the earth. An increase in volcanic ash, which is carbon being emitted from the earth's mantle through the crust and into the atmosphere, would lead to a dramatic increase in reflective coverage of the earth's surface. Thus there would be initial increase in the trapping of solar visible radiation (energy) that would increase atmospheric temperature, yet as time went on the cloud of ash would reflect visible rays ~~to the~~ away from the earth's surface leading to a decrease in atmospheric energy, and atmospheric temperature, ultimately leading to global cooling.

5

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are similar in that they are both a reaction to chemical energy and a release of ~~ener~~ molecules into the atmosphere through

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

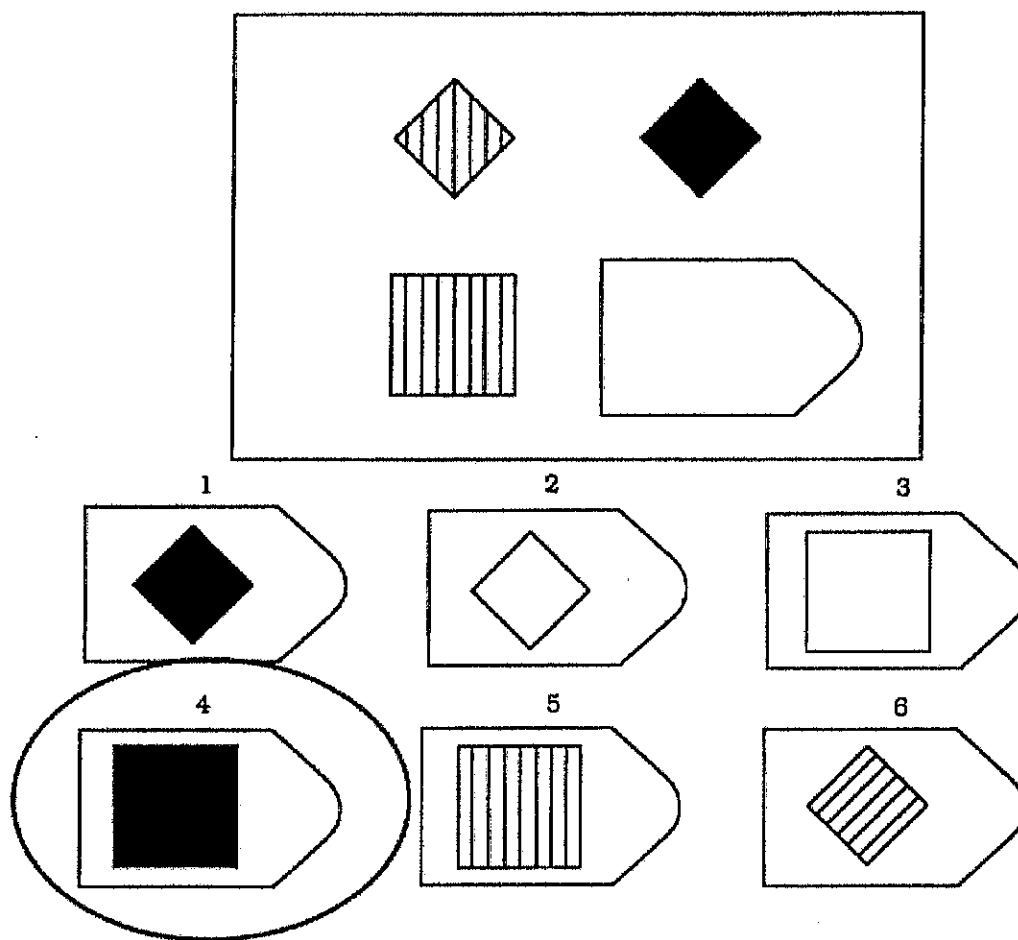
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# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

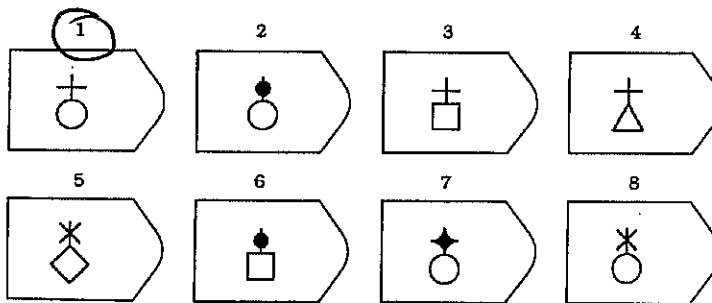
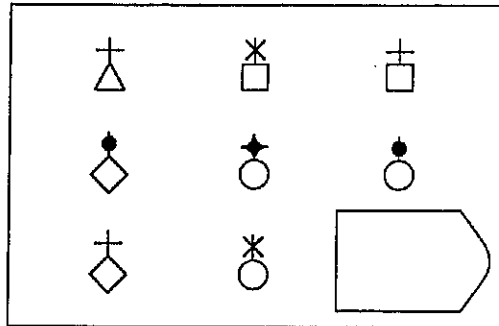


**Answer: 4**

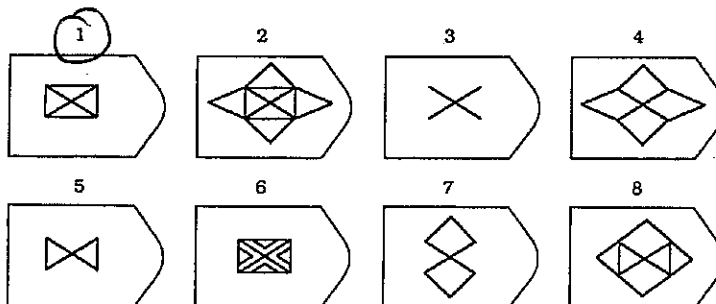
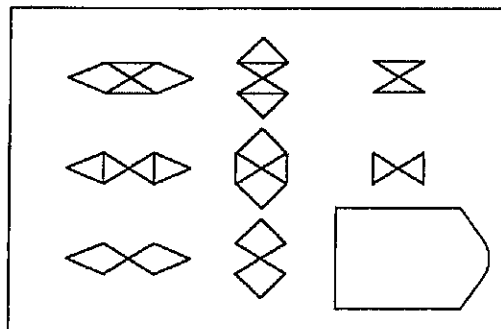
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Please choose the image that best completes each of the following patterns.

### PATTERN 1

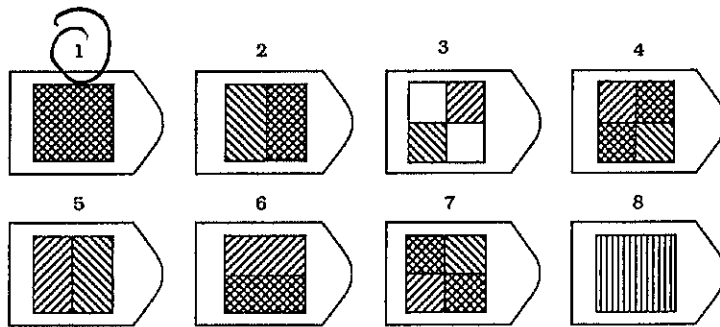
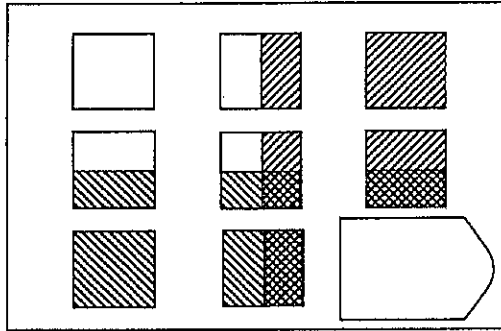
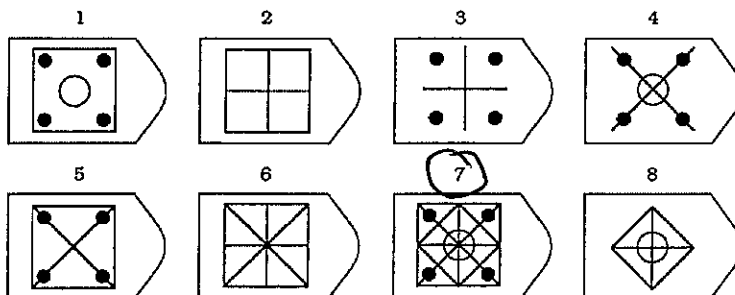
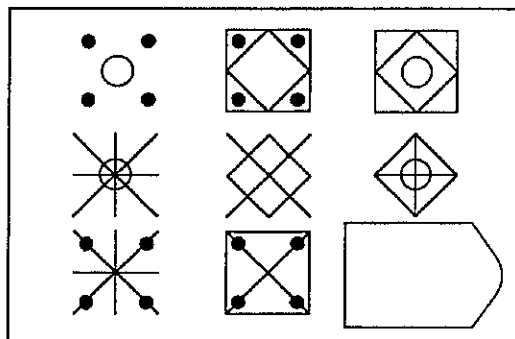


### PATTERN 2

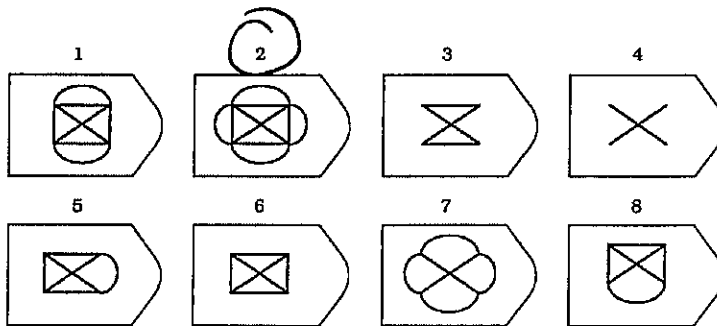
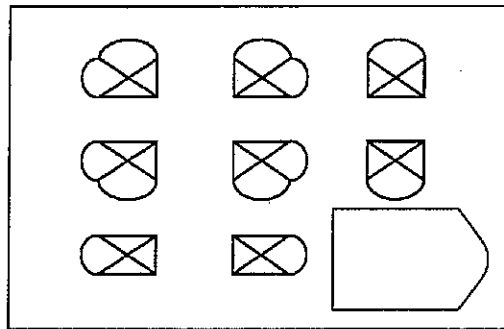


PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

**Please choose the best analogy to each of the following statements.**

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.
  - A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
  - B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
  - ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
  
2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.
  - A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
  - B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
  - C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
  - ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.
  
3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.
  - ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
  - B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
  - C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
  - D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.
  
4. The rival gangs used graffiti to define their territorial boundaries.
  - A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
  - B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
  - ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
  - D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

*PLEASE CONTINUE ON NEXT PAGE*

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 22 years

What is your home zip code? 48301

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A43835916  
Version B

GROUP: C11

50

MULTIPLE-CHOICE. 5 points each (50 points total).

1. Which of the following would be considered a negative feedback to increasing global temperature?
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
- ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
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- ☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☒ a. The magma becoming colder
- ☒ b. Gas bubbles forming in the magma
- ☐ c. The surrounding crust becoming hotter
- ☒ d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
- ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition
- ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
- ☐ d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☐ a. Human activities are the primary cause of the greenhouse effect.
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- ☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
- ☐ e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☒ a. Reservoir A has a shorter residence time than Reservoir B.
- ☒ b. Reservoir B has a shorter residence time than Reservoir A.
- ☐ c. Reservoir A and Reservoir B have equal residence times.
- ☐ d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B ☒ a. The reservoir will eventually disappear.  
☒ b. The reservoir is not in equilibrium.  
☒ c. The reservoir is growing smaller.  
d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- D ☒ a. The Earth's atmosphere would become colder than it is today.  
☒ b. The Earth's atmosphere would become warmer than it is today.  
c. The Earth's atmosphere would remain about the same temperature as it is today.  
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9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
b. Reflection of more solar radiation, causing atmospheric temperature to increase  
c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- D ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

bonds form = energy released

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

When there is more greenhouse gases in the atmosphere, including  $\text{CO}_2$ , the  $\text{CO}_2$  gets absorbed into the oceans making the oceans more acidic. It is the same as if there were less  $\text{CO}_2$  in the atmosphere, the oceans would be less acidic because there would not be as much  $\text{CO}_2$  being absorbed into the ocean. If there was an increase in  $\text{CO}_2$  in the atmosphere, the acidity of the oceans would increase creating a positive feedback loop. However, if there were more  $\text{CO}_2$  in the atmosphere, there would be more greenhouse gases in the atmosphere keeping the sun from getting to the Earth's surface. If there was less sun reaching the Earth, one could conclude that the Earth's temperature would be decreasing, which in turn means a decrease in the amount of water being evaporated, condensed, and precipitated. If these processes slowed, there would be less acidity in the oceans because molecules would not be moving as fast, making the absorption of  $\text{CO}_2$  in the oceans more difficult and therefore resulting in a negative feedback loop.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Volcanism has to do with magma rising through the layers of the Earth's surface. When magma rises, it starts out hot because it is closer to Earth's core. While the magma is warm, it moves faster through the layers of rocks and degasses releasing bubbles making it flow faster. As the magma gets closer to the Earth's surface, it begins to slow down because the rock around the magma is cooler and cools it. If an increase in volcanism occurred, it is unclear whether temperature of Earth would increase or decrease. It is possible for Earth's temperature to increase because the large ash clouds will create more greenhouse gases which will trap the visible rays from the sun in Earth's atmosphere, ultimately heating up the Earth. However, it is possible for the Earth's temperature to decrease because the greenhouse gases will be reflecting the sun's rays back into space and will not be able to pass through the Earth's atmosphere to warm the temperature. Whether or not the Earth's temperature increases or decreases depends on the amount of visible light the greenhouse gases allow to pass through the atmosphere and how much the gases reflect the light.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are similar in that both increase while at a warmer temperature because atoms are more free to move



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

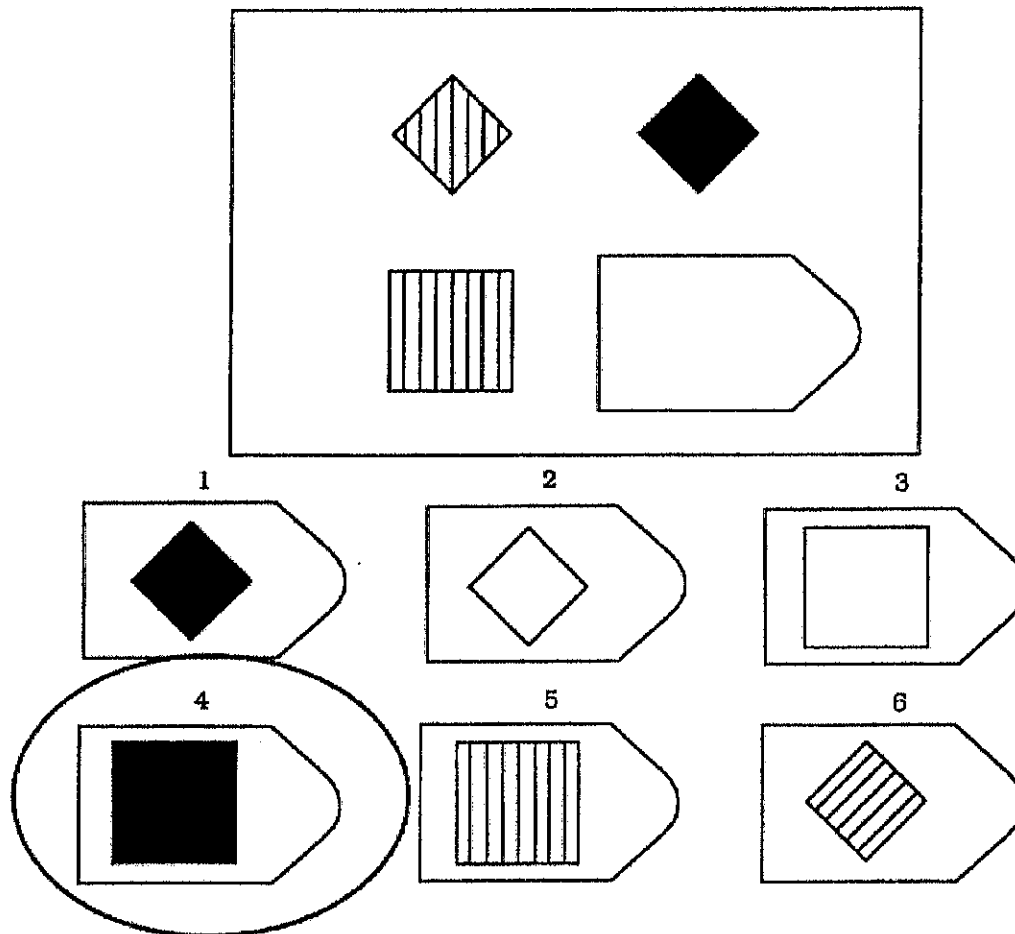
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

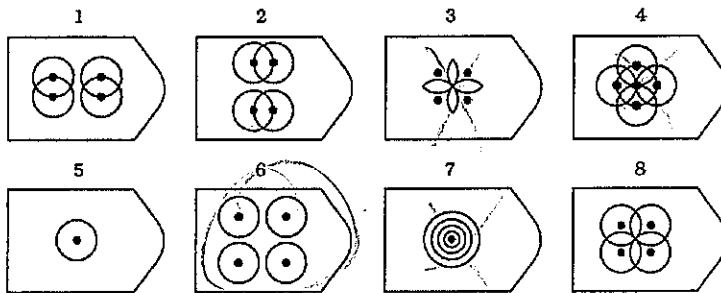
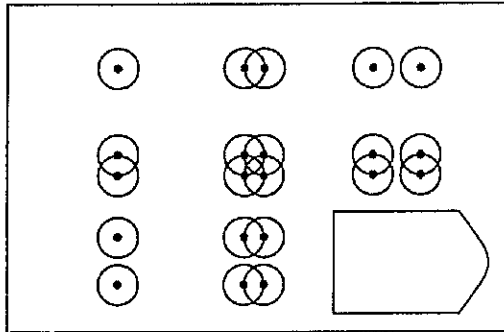
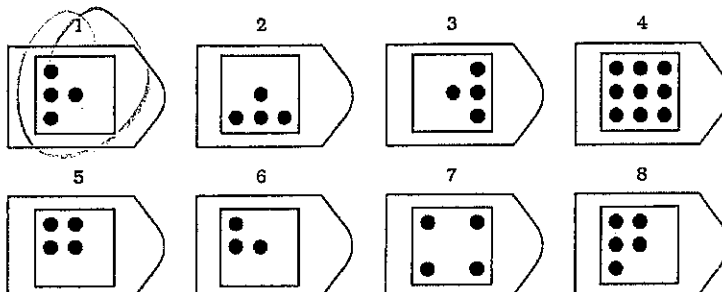
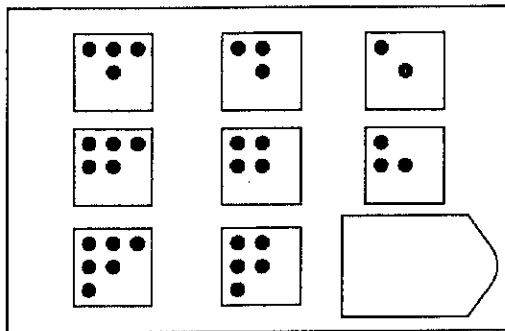


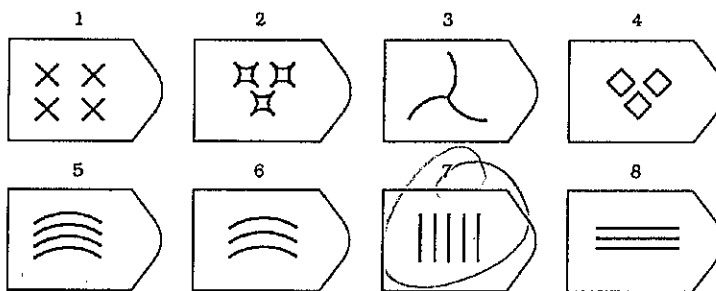
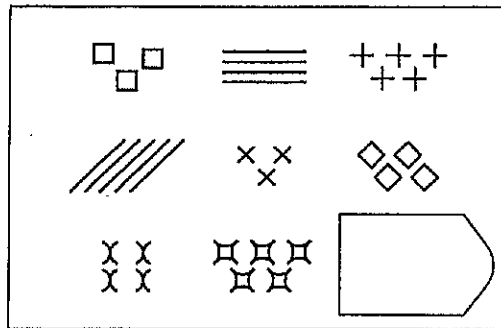
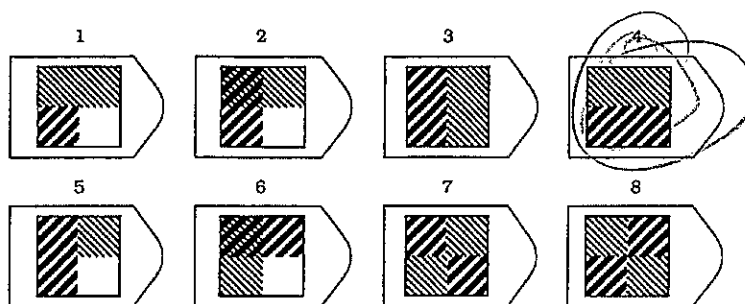
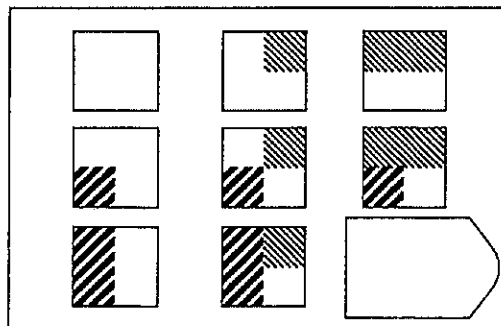
**Answer: 4**

PLEASE CONTINUE ON NEXT PAGE

A43838916

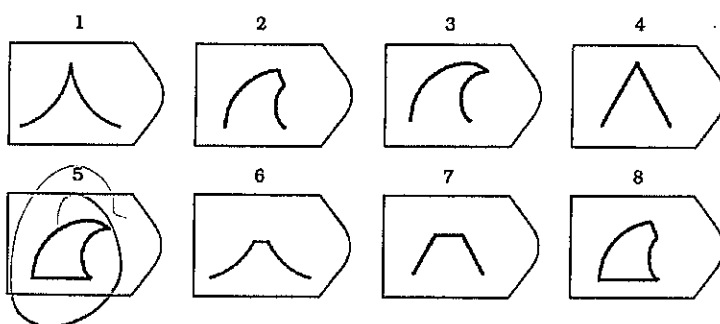
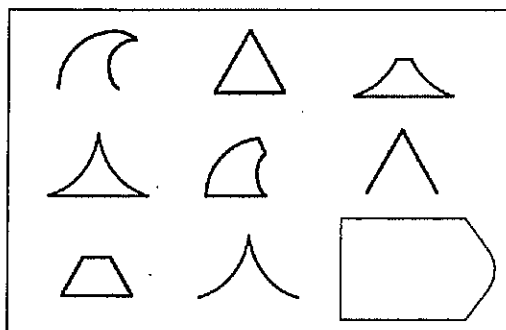
Please choose the image that best completes each of the following patterns.

**PATTERN 1****PATTERN 2**

**PATTERN 3****PATTERN 4**

A43835916

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

#### DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48451

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A42154647  
Version B

GROUP: \_\_\_\_\_

C11

42

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature? ☒ C
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface? ☒ D
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C. ☒ C
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate? ☒ B
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time? ☒ B
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease? ☒ B
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

$$\frac{A}{1000} = 10 \quad \frac{B}{500} = 5$$

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true? ☒ B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates? ☒ A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation? ☒ D
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☒ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true? ☒ B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric  $\text{CO}_2$  would cause the acidity of the ocean to increase. Acidity is the measure of the amount of hydrogen ions in a solution and according to the equation,  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$ , Carbon dioxide plus water will yield hydrogen ions. If there is more atmospheric  $\text{CO}_2$ , then we can assume the temperature is increasing. This means there will then be more evaporation out of the Ocean. This will cause more water to combine with the  $\text{CO}_2$  in the atmosphere and lead to an increase in ocean Acidification. This is a positive feedback loop. A way to slow down this process would be to legislate lower  $\text{CO}_2$  emissions. This is an example of A negative Feedback loop.

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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

4

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If volcanism on Earth increase and there is more sulfur in the atmosphere, then there will be <sup>more</sup> infrared radiation reflected back out of the atmosphere instead of being held in the atmosphere as heat. This will cause the global temperature to decrease. Sulfur in the atmosphere reacts differently than greenhouse gases do because the greenhouse gases trap heat in the atmosphere and cause global temperatures to increase. Sulfur, on the other hand, reacts like microscopic umbrellas to reflect heat back out of the atmosphere. The main greenhouse gases that trap IR in the atmosphere after it's been reflected off the surface are  $\text{CO}_2$ , methane, and  $\text{O}_2$ .

2

01

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

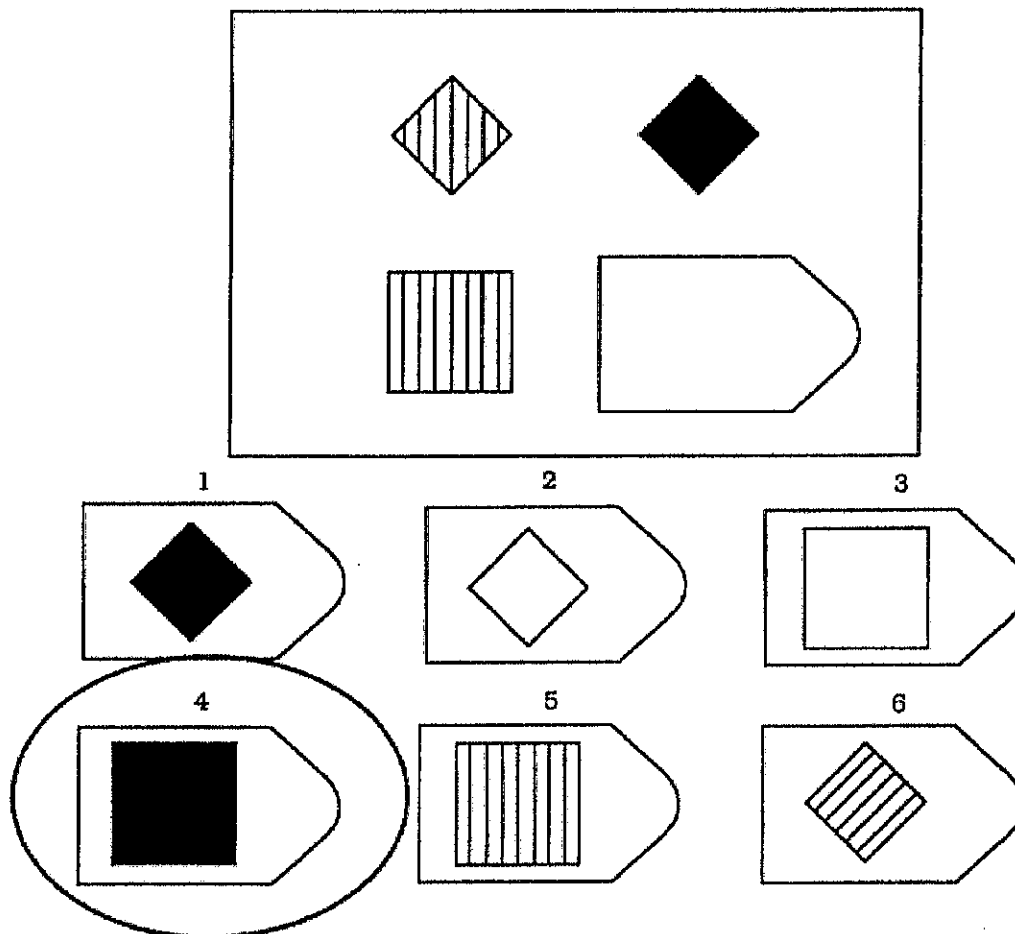


# Analogical Assessment

---

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

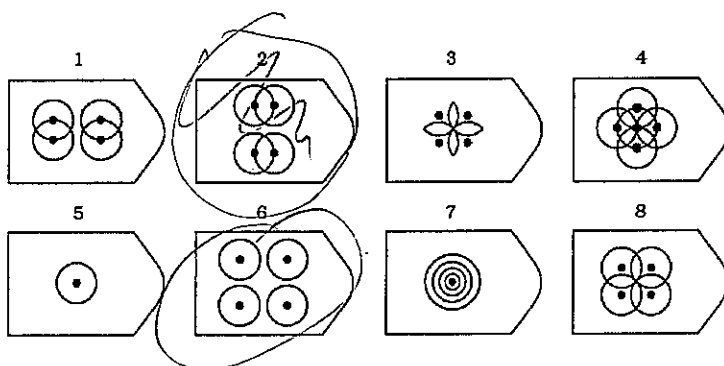
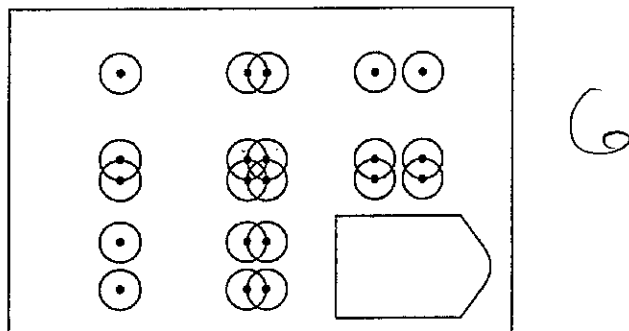


**Answer: 4**

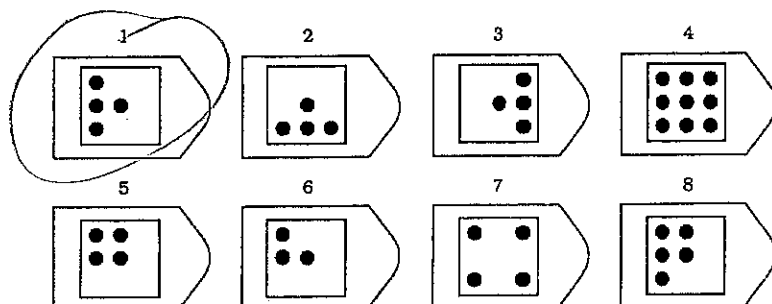
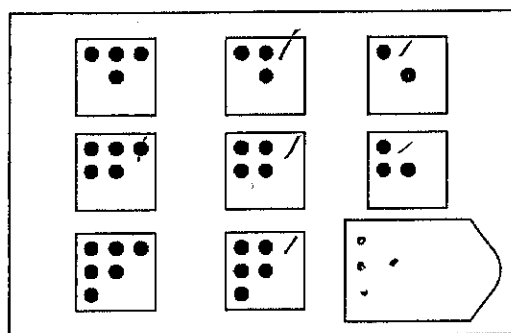
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

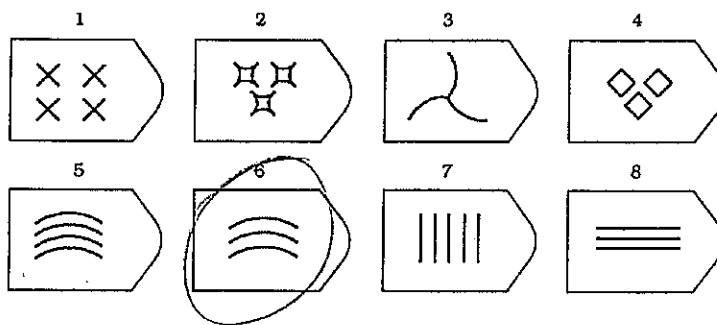
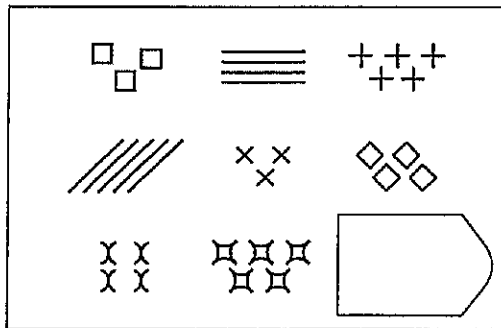
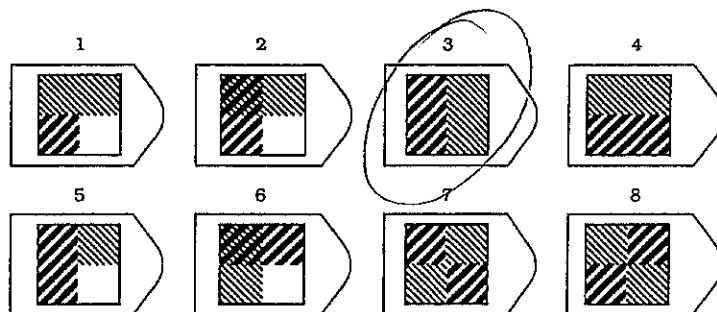
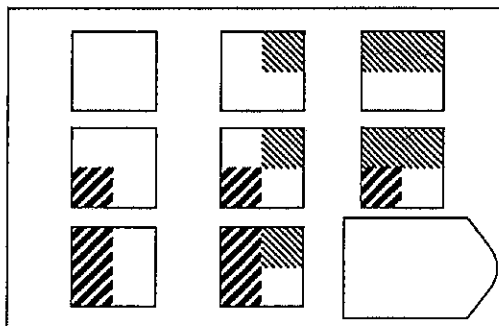
### PATTERN 1



### PATTERN 2

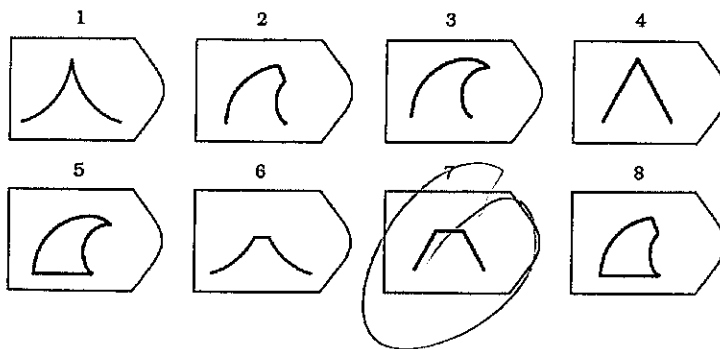
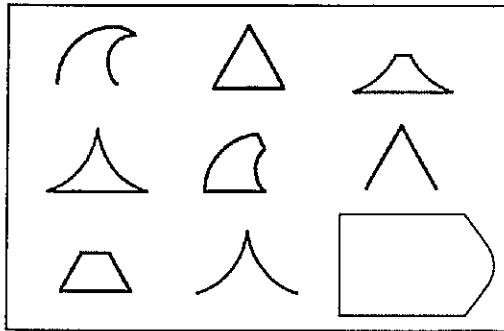




**PATTERN 3****PATTERN 4**

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## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

A42154647

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
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- 

Please choose the response that is closest to an analogy that you might make.

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2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48127

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A43773910  
Version B

GROUP: C11

34

MULTIPLE-CHOICE. 5 points each (50 points total).

1. Which of the following would be considered a negative feedback to increasing global temperature?  
a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
b. Melting of permafrost resulting in more methane escaping into the atmosphere  
c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. The magma becoming colder  
b. Gas bubbles forming in the magma  
c. The surrounding crust becoming hotter  
d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A= erosion, B= deposition, C= uplift and erosion  
b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
a. Human activities are the primary cause of the greenhouse effect.  
b. Natural processes are the primary cause of the greenhouse effect.  
c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
a. Reservoir A has a shorter residence time than Reservoir B.  
b. Reservoir B has a shorter residence time than Reservoir A.  
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d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?  
a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true? D
- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates? *less gas emissions* D
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation? A
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true? C
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Carbon dioxide in the atmosphere affects carbon dioxide levels in the ocean through the cycle of ocean acidification. Through series of precipitation, evaporation, and transfer; high carbon dioxide levels in the atmosphere will become high carbon dioxide levels in the ocean. This will increase ocean acidification, causing some ocean life to die; which in turn adds more  $\text{CO}_2$  from their marine skeletons. This is a positive feedback. Because more  $\text{CO}_2$  causes higher acidity, which causes even more  $\text{CO}_2$  to be added to the cycle.

1

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

expl. The greenhouse effect is the warming of earth's atmosphere through the emission of greenhouse gases. When the sun emits energy, the visible light passes through to earth's surface, where it is either absorbed or reflected back. The more visible light that is let through, and absorbed, the more the atmosphere gets heated. When volcanoes erupt large ash clouds, often the ash stays in the atmosphere for long periods of time, which in turn blocks energy from being able to pass through to earth's surface. Because less light is being let through, less is being absorbed, so the atmosphere is being less heated. So, if volcanism increases dramatically with ones that erupt large ash clouds, then the ash would bog down the atmosphere, letting less light through, which in turn causes a decrease in atmospheric temperature.

18

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

---



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

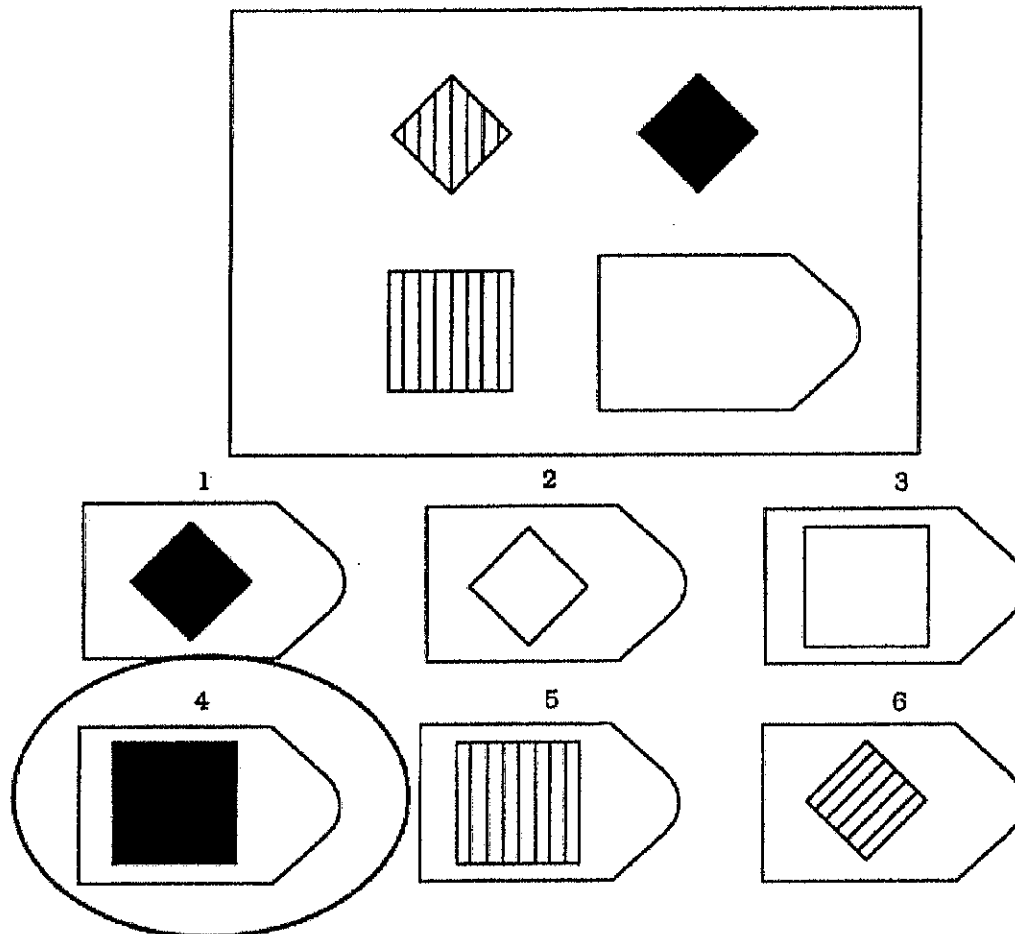
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

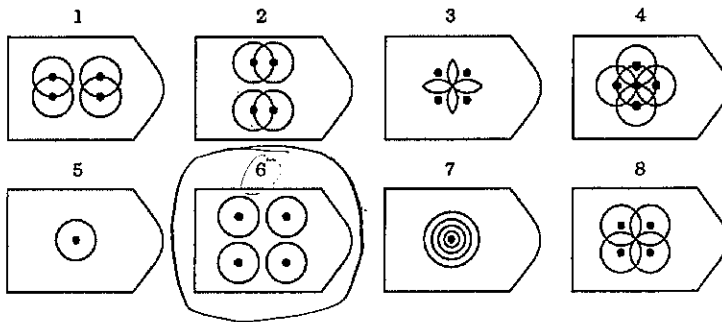
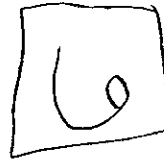
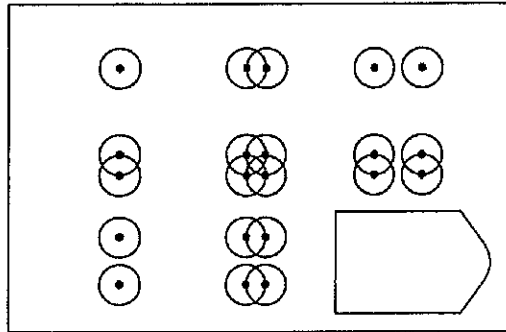


**Answer: 4**

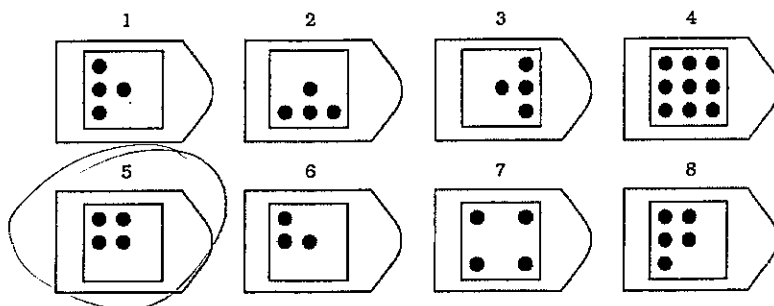
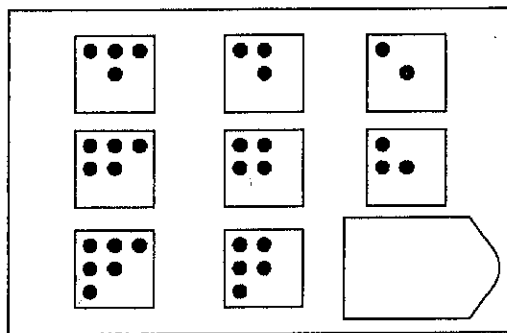
PLEASE CONTINUE ON NEXT PAGE

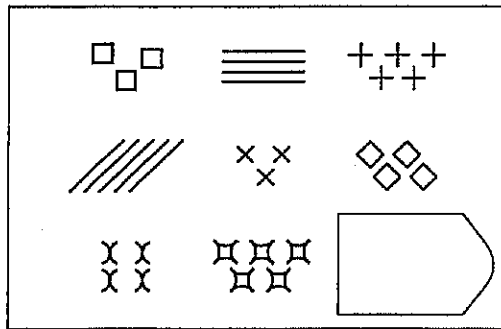
Please choose the image that best completes each of the following patterns.

### PATTERN 1

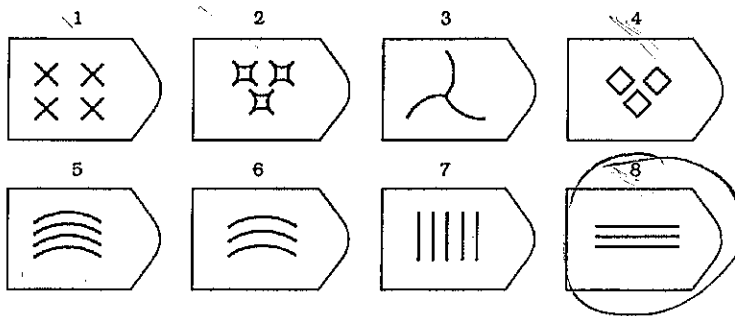
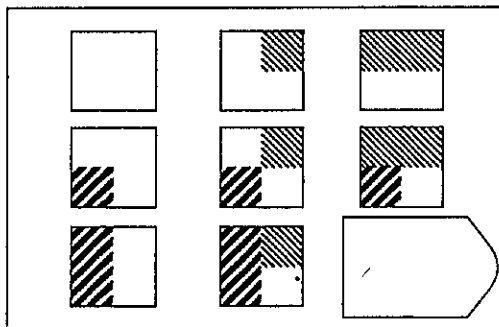


### PATTERN 2

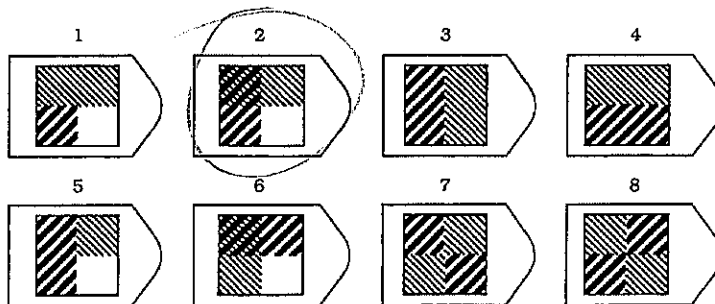


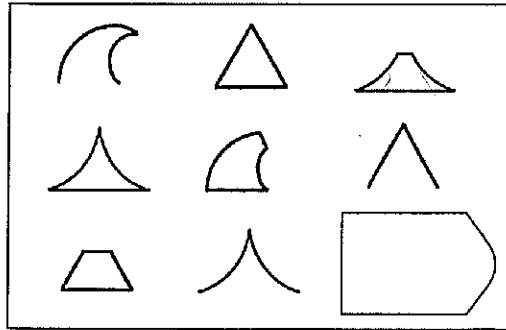
**PATTERN 3**

8

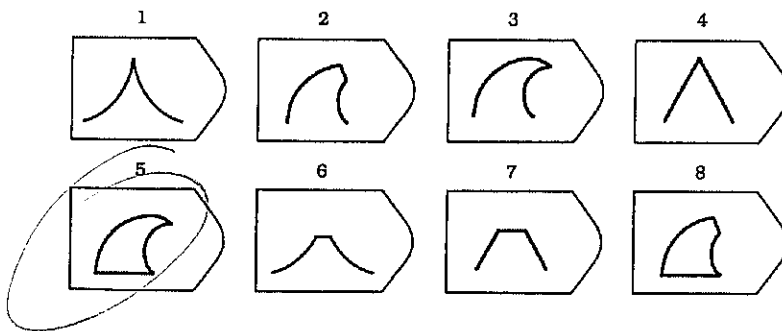
**PATTERN 4**

2



**PATTERN 5**

5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
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- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- ☒ B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 49058

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



STUDENT NAME: A421 2058  
Version B

GROUP: [Yellow Box]

35

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?  
a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
b. Melting of permafrost resulting in more methane escaping into the atmosphere  
☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere C
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. The magma becoming colder  
☒ b. Gas bubbles forming in the magma B  
c. The surrounding crust becoming hotter  
d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A= erosion, B= deposition, C= uplift and erosion  
b. ~~A= erosion, B= biochemical precipitation, C= uplift and deposition~~  
☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. ~~A= dissolution, B= deposition, C= uplift and deposition~~ C
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
a. Human activities are the primary cause of the greenhouse effect.  
☒ b. Natural processes are the primary cause of the greenhouse effect. B  
c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
a. Reservoir A has a shorter residence time than Reservoir B.  
b. Reservoir B has a shorter residence time than Reservoir A.  
☒ c. Reservoir A and Reservoir B have equal residence times. C  
d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?  
a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash. B  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - ☒ d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

The increase in atmospheric carbon dioxide would affect the ocean acidification by increasing it. The acidification in the ocean is caused by the  $\text{CO}_2$  levels in the atmosphere and their connection with the  $\text{CO}_2$  in the water. When there is less  $\text{CO}_2$  in the atmosphere then there is less  $\text{CO}_2$  in the water. The negative feedback loops of the process of ocean acidification is that it is never a stable increase or decrease because the levels will always be changing. The positive feedback loop to the process of ocean acidification is that there is a constant connection with the  $\text{CO}_2$  in the different reservoirs keeping the cycle stable and not changing.

15

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

This new increase in volcanism will affect the Earth's atmospheric temperature by decreasing it. Once the large ash clouds are in the atmosphere the sun's rays will be reflected off of the clouds which will cause none of the rays to heat the earth. With the greenhouse gases still in the atmosphere they will still be able to be released from the earth and pass through the ash clouds.

5

X

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are both similar because they deal with the transition between gas and liquid. The difference is evaporation is the water cycle going from liquid to gas and degassing is going from gas to liquid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

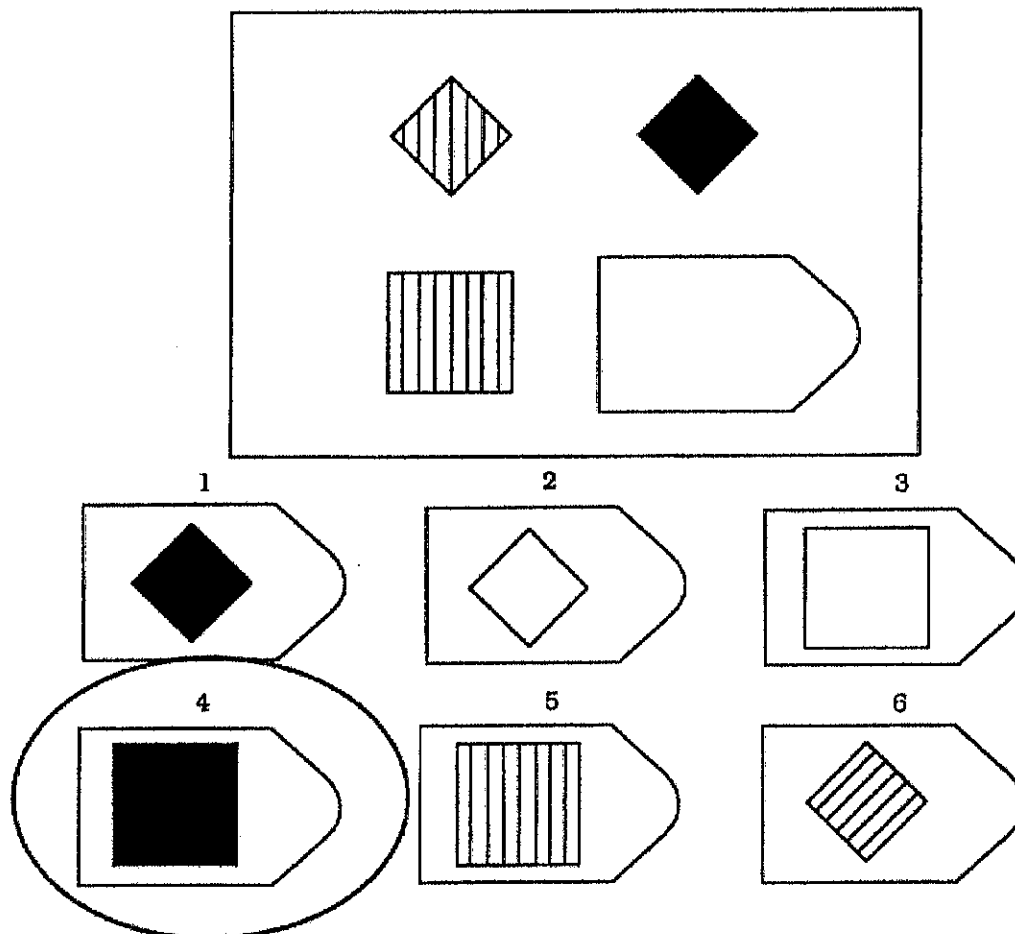
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

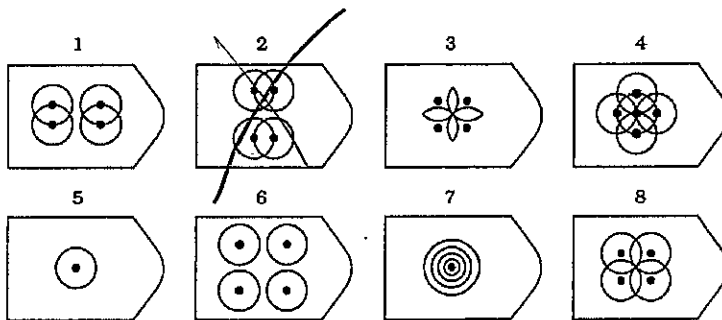
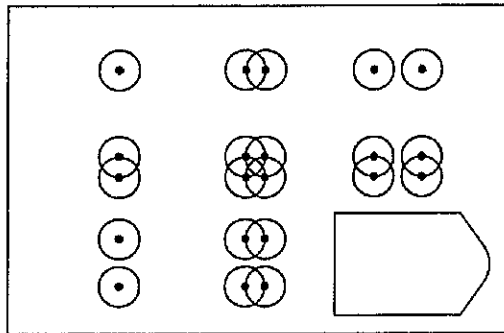


**Answer: 4**

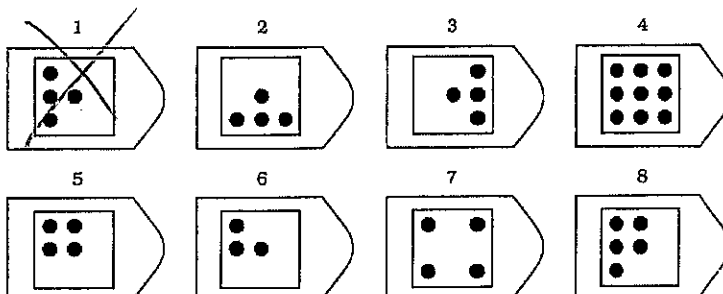
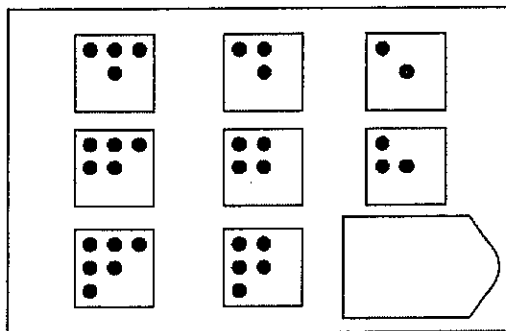
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

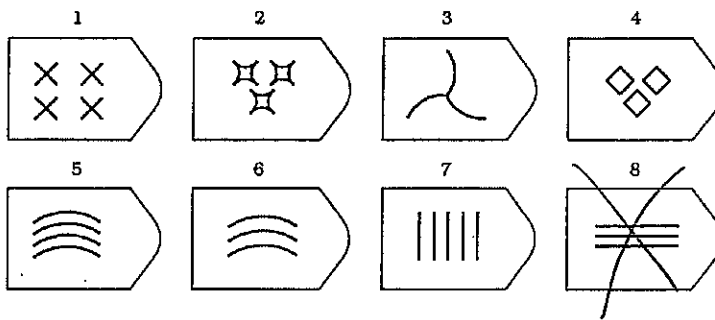
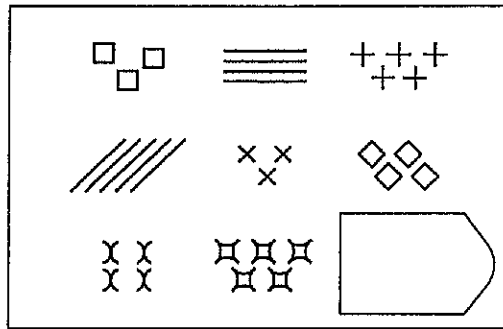
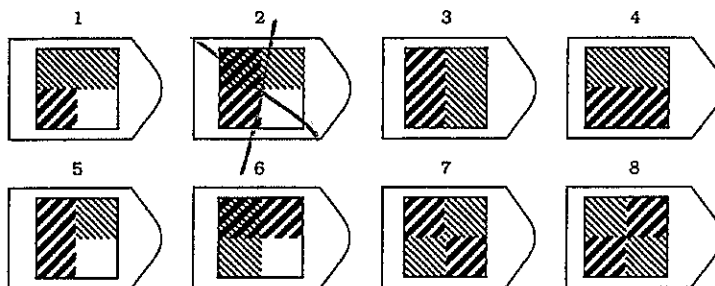
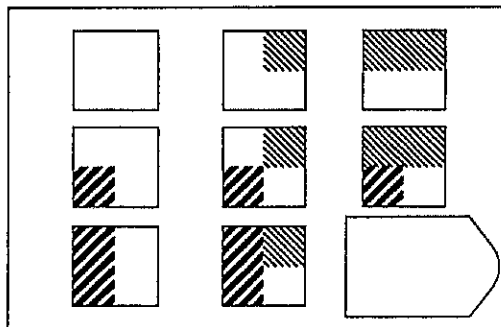
### PATTERN 1

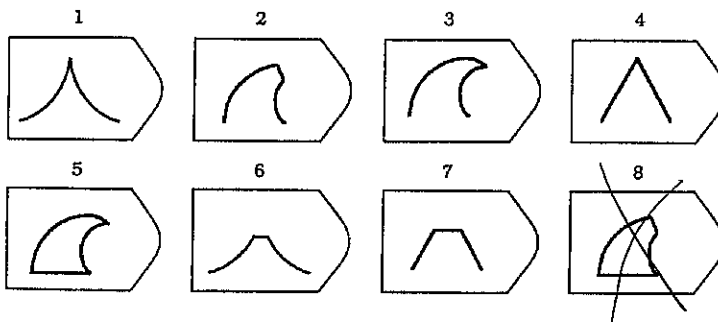
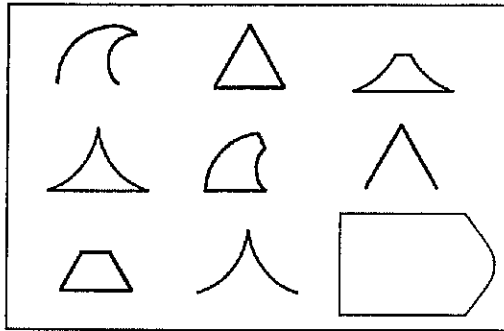


### PATTERN 2





**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

B

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

A

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

☒ Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

D

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

C

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class. A

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
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- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions. C
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- ☒ D. Building a house. They are similar because they both involve building a structure. D

### DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48167

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A40920866  
Version A

GROUP: C12

77

MULTIPLE-CHOICE. 5 points each (50 points total).

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- B
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma - causes to erupt
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- C
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere - blocks sun light
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- C
- a. A=erosion, B=deposition, C=uplift and erosion
  - b. A=erosion, B=biochemical precipitation, C=uplift and deposition
  - ☒ c. A=dissolution, B=biochemical precipitation, C=uplift and erosion
  - d. A=dissolution, B=deposition, C=uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- B
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- C
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- B
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

$$\frac{500}{100} = 5$$

$$\frac{1000}{100} = 10$$

ie A  $\frac{\text{influx}}{100} = \frac{\text{out}}{100}$   
B 100 100

cold temps foster oceanic CO<sub>2</sub>  $\therefore$   $\uparrow$  temp =  $\downarrow$  acidity

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. ~~The reservoir will eventually disappear.~~
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. ~~Re-emitting of more infrared radiation, causing atmospheric temperature to increase~~
  - d. ~~Re-emitting of more infrared radiation, causing atmospheric temperature to decrease~~

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- C
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- D
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would ultimately cause ocean acidification to increase, but not as much as many would think. When the amount of  $\text{CO}_2$  in one reservoir increases there is a chain reaction causing it to increase in other reservoirs as well. This happens because of the equilibrium principle. When applying this to the equation  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$  we see that  $\text{CO}_2$  in combination w/ the water in the oceanic reservoir creates the acidic  $\text{HCO}_3^-$ . In theory, this would be a positive feedback loop since it continues the atmospheric trend of the temperature progressively increasing. The reason this increase isn't enough to, in turn, increase ocean acidification is because a warmer water temperature lowers the oceans ability to retain carbon in its acidic form. This is a negative feedback loop. All in all, the positive & negative loops balance each other while still allowing for an equilibrium between residences.

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If volcanism on Earth were to increase dramatically it would result in a cooler globe, but only temporarily. The reasoning behind this pertains to the volcano generated ash clouds impact on the greenhouse gas effect. When the sun emits solar energy that energy makes its way to the Earth's surface where it is absorbed and sent back into the atmosphere in the form of infrared energy. When this infrared energy gets high enough in the atmosphere it interacts with greenhouse gases and ends up being trapped in the atmosphere, almost as if there were a ceiling on it, and retains heat. If volcanic ash clouds are in the way of sunlight (AKA solar energy) they reduce the amount of energy that is even capable of becoming trapped IR energy, this makes the globe net cooler. The reason this temperature change would only be temporary is that as the ash clouds dwindle away solar energy is slowly but surely let in again. This allows the globe to heat as it would if the ash clouds were not present.

20

## 2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation & degassing both take an element in one reservoir & transfer it to a gaseous state in another reservoir; however, evaporation turns a liquid to a gas and degassing just transfers a gas from one reservoir to another.



A40920864

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

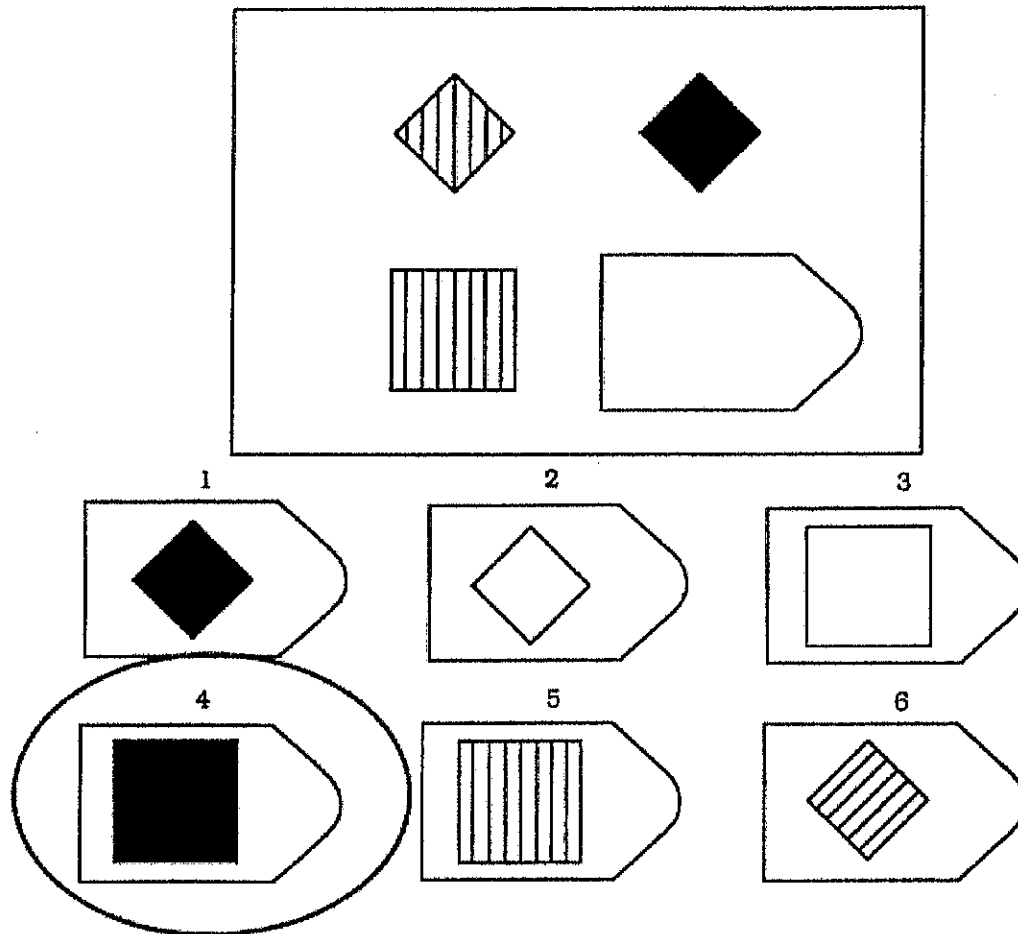
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



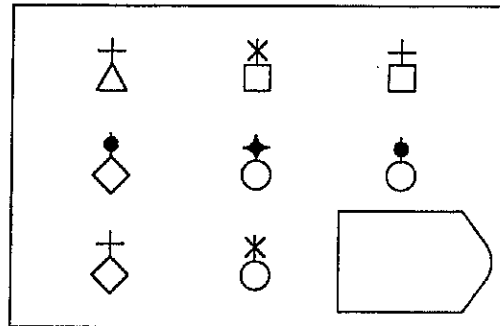
**Answer: 4**

PLEASE CONTINUE ON NEXT PAGE

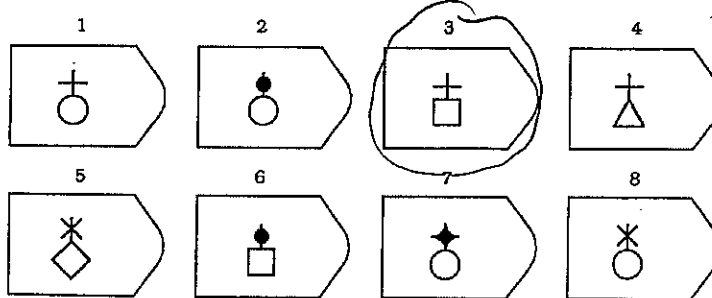
A40920866

Please choose the image that best completes each of the following patterns.

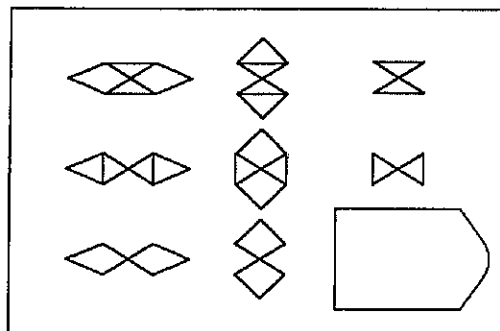
### PATTERN 1



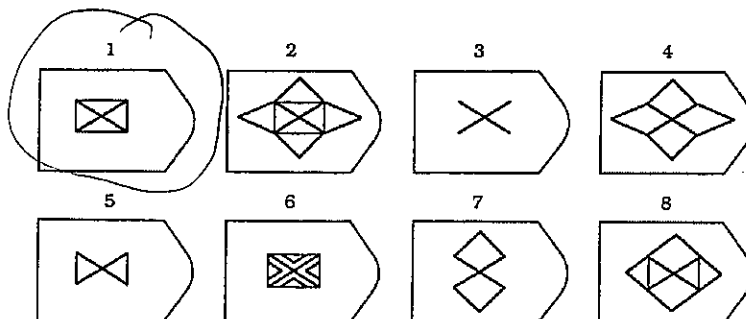
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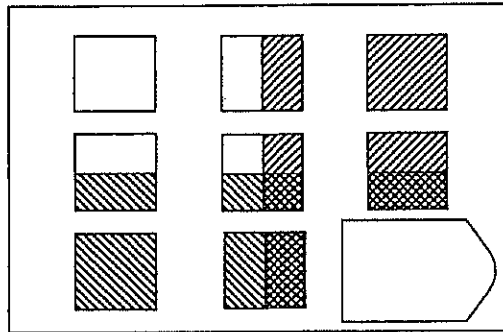


### PATTERN 2

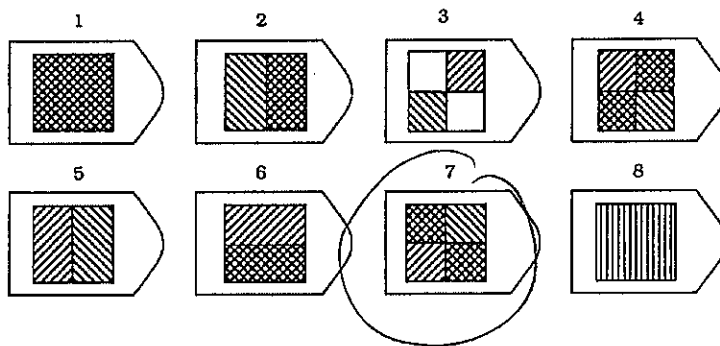
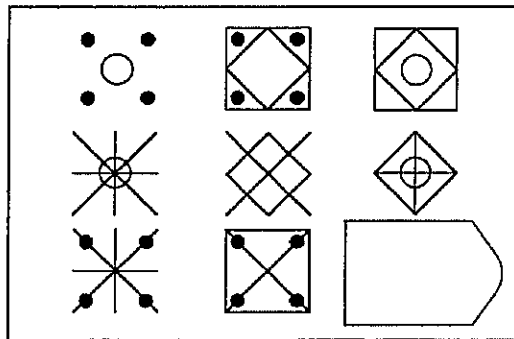


1

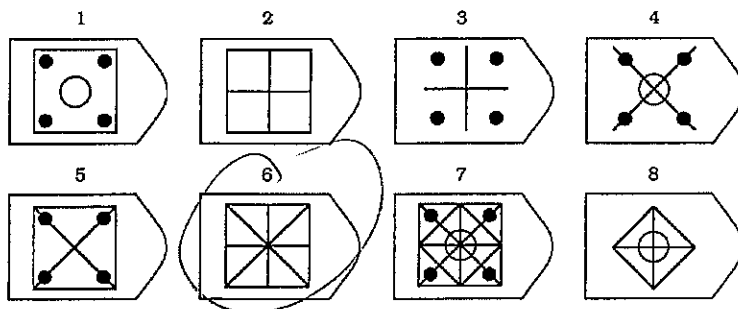


**PATTERN 3**

7

**PATTERN 4**

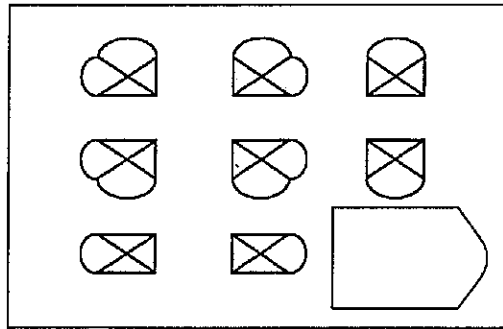
6



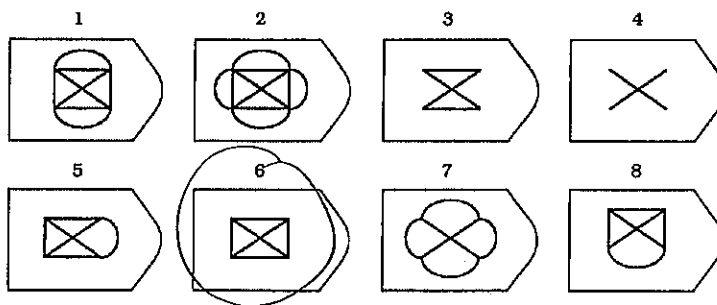
PLEASE CONTINUE ON NEXT PAGE

## PATTERN 5

A40920866



6



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

A40920866

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

A40920866

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- ☒ B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- ☒ C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- ☒ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48130

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other



STUDENT NAME: A43272485  
Version A

GROUP: C12

43

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - ☒ c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A dissolution. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B biochem and compaction, and then limestone becomes exposed at Earth's surface through the processes of C uplift and erosion.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

100

A = 500	50	50
B = 250	25	50

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- ☒ a. The reservoir will eventually disappear.
  - ☐ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- D
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- D
- ☐ a. The Earth's atmosphere would become colder than it is today.
  - ☐ b. The Earth's atmosphere would become warmer than it is today.
  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would cause there to be higher concentrations of  $\text{CO}_2$  in the ocean as well and would ~~increase~~ the pH level of the ocean and increase the ocean's acidification. The  $\text{CO}_2$  in the atmosphere would have a direct impact on the  $\text{CO}_2$  levels in the ocean and increase acidification. This would be a negative feedback loop of ocean acidification because the higher acidic levels would begin to kill or "bleach" coral reefs and could potentially devastate the oceanic communities that depend on coral reef areas for food and shelter.

~~18~~ 18

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If volcanism were to suddenly dramatically increase, and large ash clouds formed in the upper atmosphere it would block out solar radiation that we depend on to sustain our environment.

This blockage of solar radiation would substantially decrease the atmospheric temperature. The "greenhouse effect" however which is a naturally occurring incidence as well as done by human activity in burning fossil fuels, would dramatically increase the atmospheric temperature. Normally during the "greenhouse effect" gases are

released out through the top of the atmosphere, naturally and man-caused gases alike, however some are radiated back towards Earth, with the volcanic ash blocking the upper atmosphere, far fewer of these gases would be released out and it would increase the atmospheric temperature.

It can really not be known how exactly the Earth's atmospheric temperature would react under two polar opposite dramatic occurrences.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

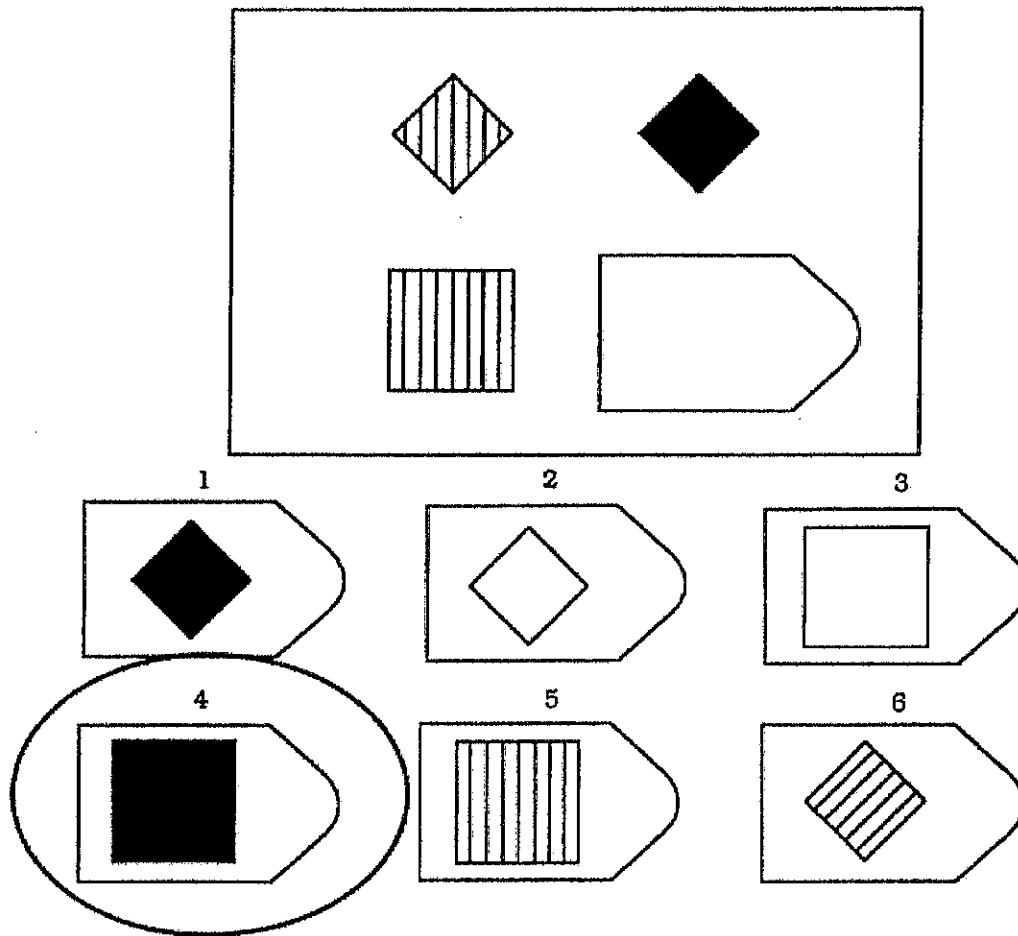
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

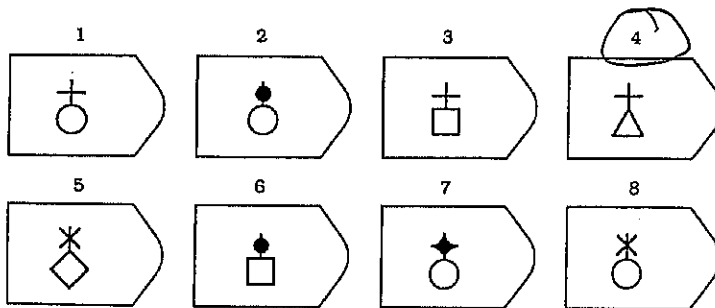
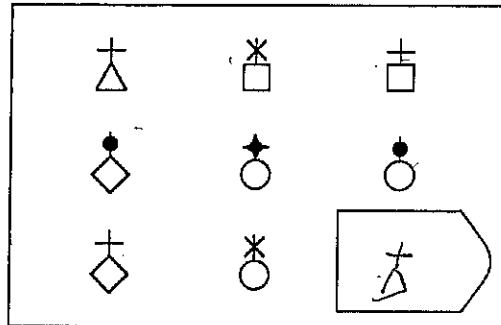


**Answer: 4**

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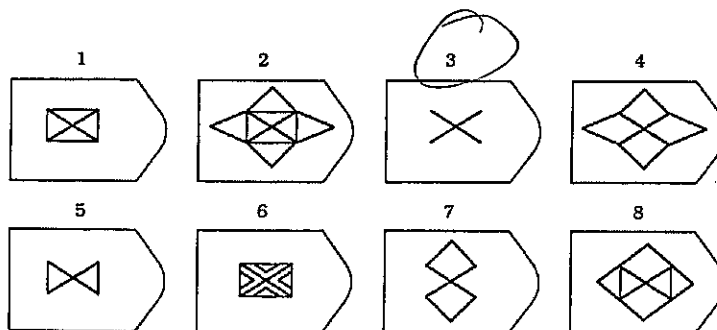
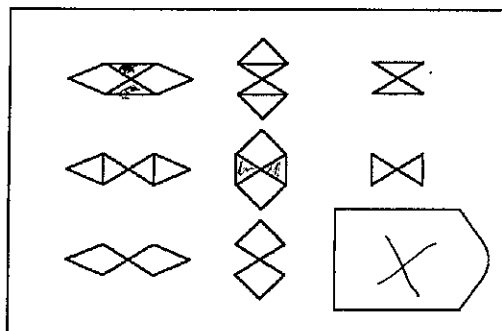
Please choose the image that best completes each of the following patterns.

### PATTERN 1



4

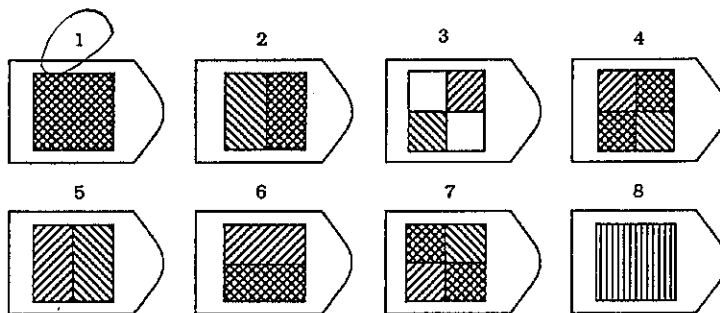
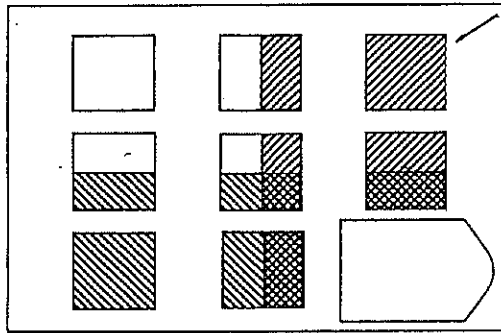
### PATTERN 2



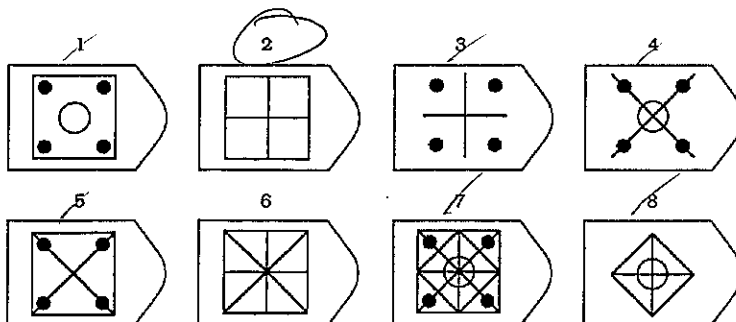
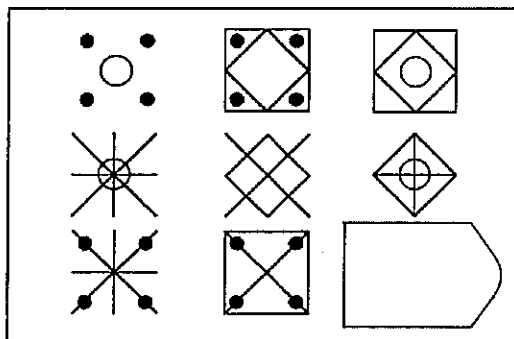
3



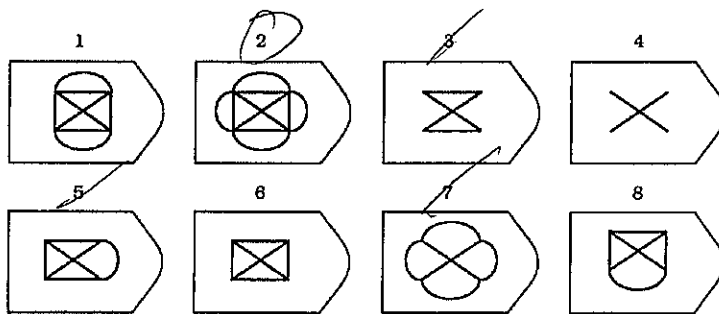
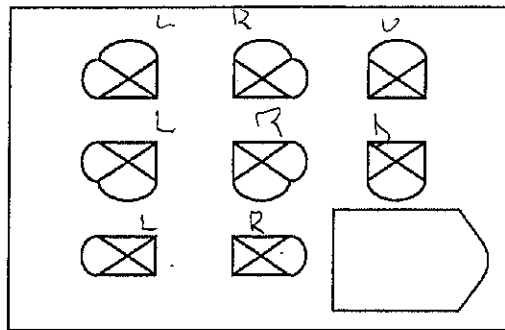
## PATTERN 3



## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
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PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

~~A.~~ The experienced locksmith did not need much time to remove the padlock that no longer had a key.

**B.** Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

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~~D.~~ Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

~~A.~~ Before the annual parade, the city council decided to renovate one of the buildings downtown.

~~B.~~ During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

**D.** ~~C.~~ Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

~~D.~~ Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

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~~A.~~ The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

**B.** ~~B.~~ Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

~~C.~~ Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

~~D.~~ The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

~~A.~~ The toddler wrote on the walls with pens when the babysitter wasn't looking.

**C.** ~~B.~~ Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

~~C.~~ The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

~~D.~~ The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.

A. The plumber fixed the pump that had burst and flooded the basement.

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C. The groom's mother mended her son's tuxedo since he had torn a hole in it.

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---

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☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.

B. A leaf in the air. They are similar because they both move through the air carried by the wind.

C. Blowing bubbles. They are similar because they both float until they eventually pop.

D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

☒ A. Getting the flu. They are similar because they are both caused by viruses.

B. Getting pink eye. They are similar because they are both contagious.

☒ C. Getting the flu. They are similar because they are both caused by not washing your hands.

D. Forgetting to do your homework. They are similar because they are both preventable.

☒ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 44708

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 43365634  
Version A

GROUP: C12

29

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - D (d) Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- A. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - B. Melting of permafrost resulting in more methane escaping into the atmosphere
  - C. An increase in evaporation and cloud formation resulting in the release of latent heat
  - D (d) An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A= erosion, B= biochemical precipitation, C= uplift and deposition
  - C (c) A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A= dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- A (a) Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - C (c) A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - B (b) Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

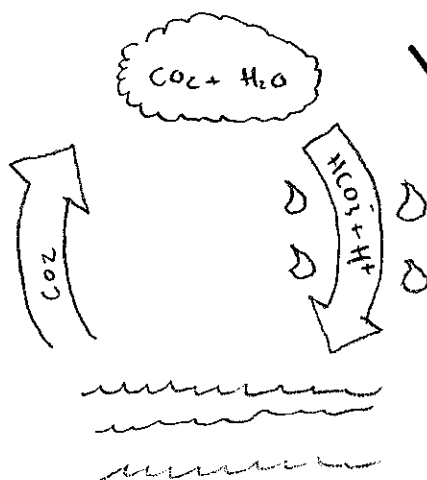
SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An Increase in atmospheric Carbon dioxide increases the acidity of oceans because  $\text{CO}_2$  mixes with  $\text{H}_2\text{O}$  in the atmosphere and ~~precipitates~~ as  $\text{HCO}_3^- + \text{H}^+$  which increases oceans acidity. This creates a positive feedback loop because the  $\text{CO}_2$  in the atmosphere mixes with  $\text{H}_2\text{O}$  and precipitates, then it evaporates and creates even more ocean acidity.



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

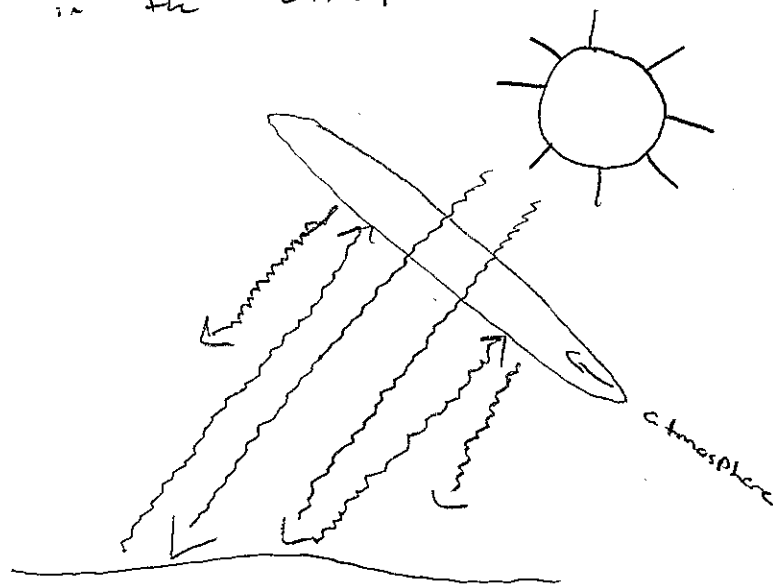
4

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If there were an increase in volcanism on the planet there would be an increase in the atmospheric temperature. This would be caused from an increase in CO<sub>2</sub> emissions that would exacerbate the greenhouse effect because the increase in CO<sub>2</sub> and other gases would trap visible light from the sun in the atmosphere.



Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Because then both involve the releasing of gas.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

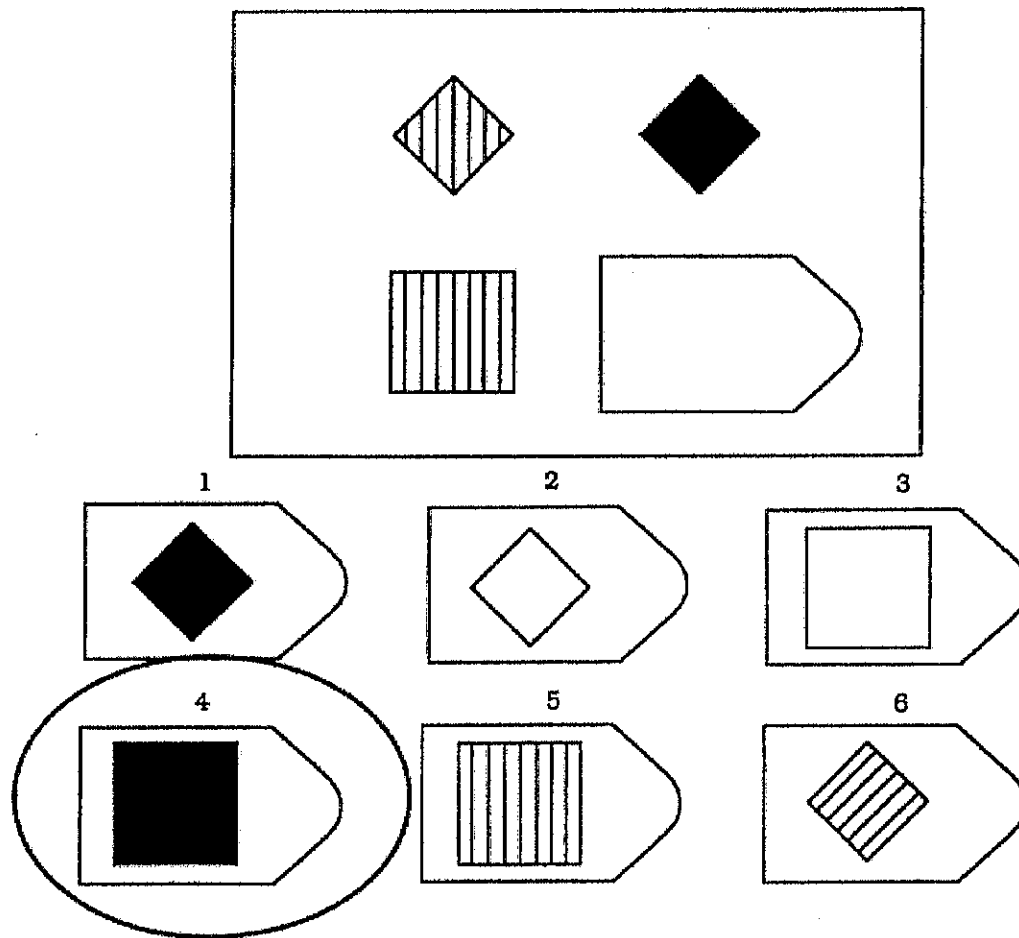
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

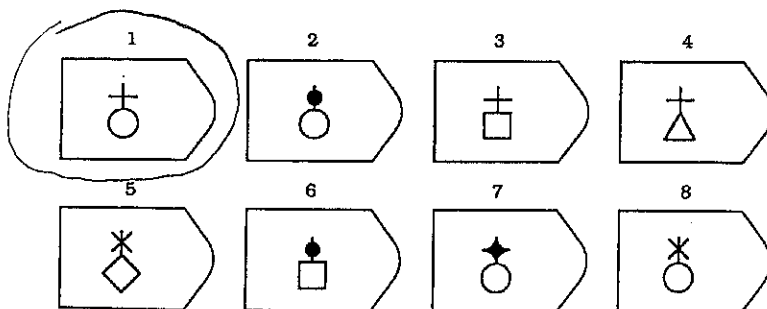
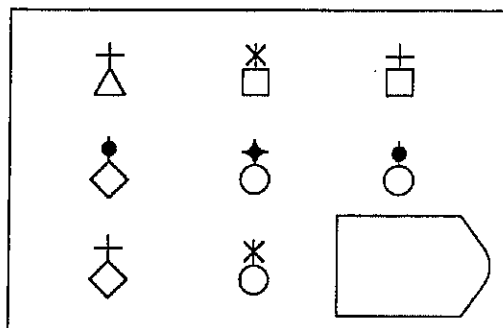


**Answer: 4**

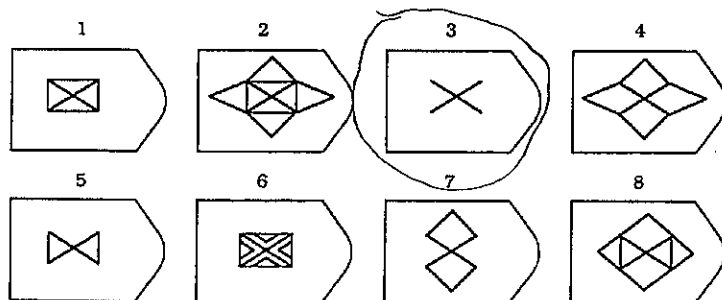
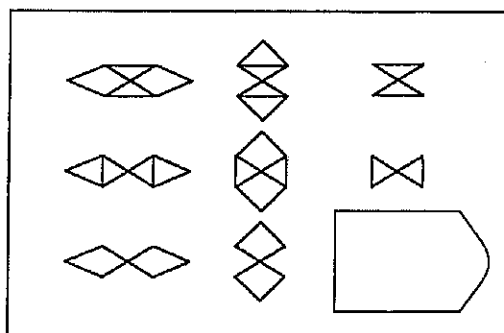
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Please choose the image that best completes each of the following patterns.

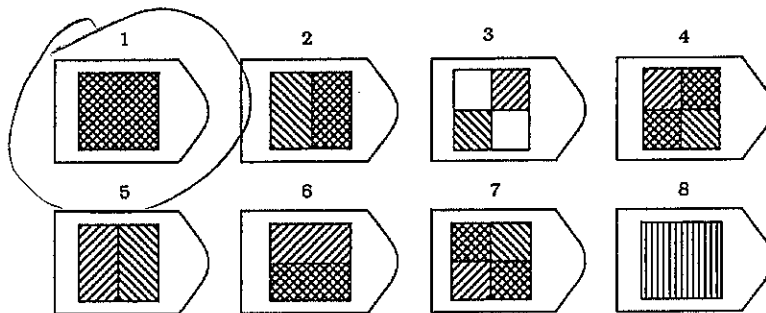
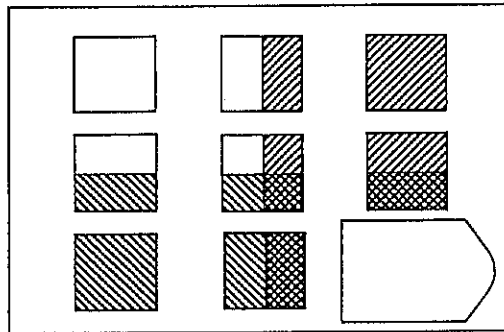
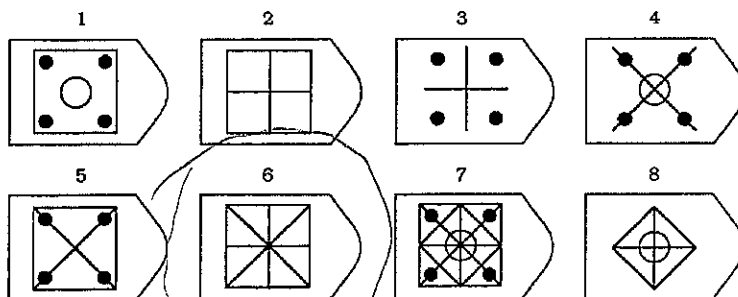
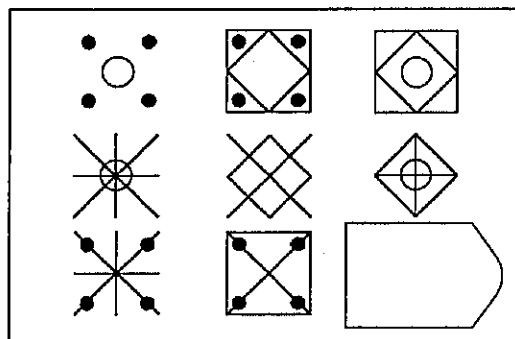
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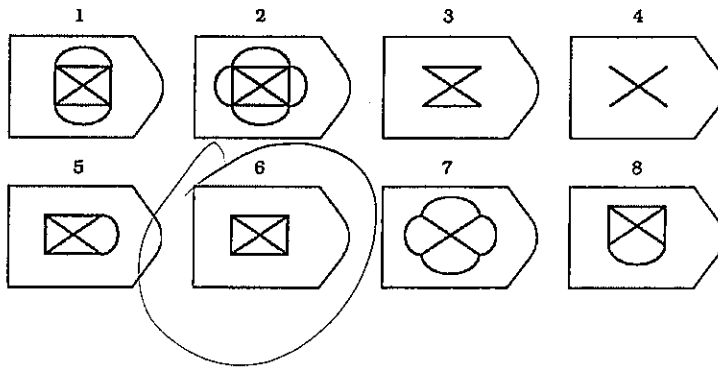
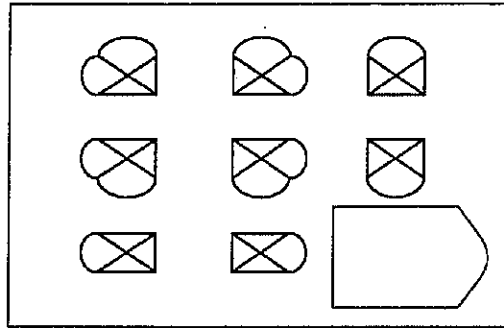
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

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- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

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- B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

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- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ☒ A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
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2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - ☒ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48189

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



STUDENT NAME: A43506836  
Version A

GROUP: C12

37

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - ☒ Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion
  - A = erosion, B = biochemical precipitation, C = uplift and deposition
  - ☒ A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - ☒ Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.

Amount  
flux

$\frac{2}{1}$   $\frac{1}{1}$

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium. 1000
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

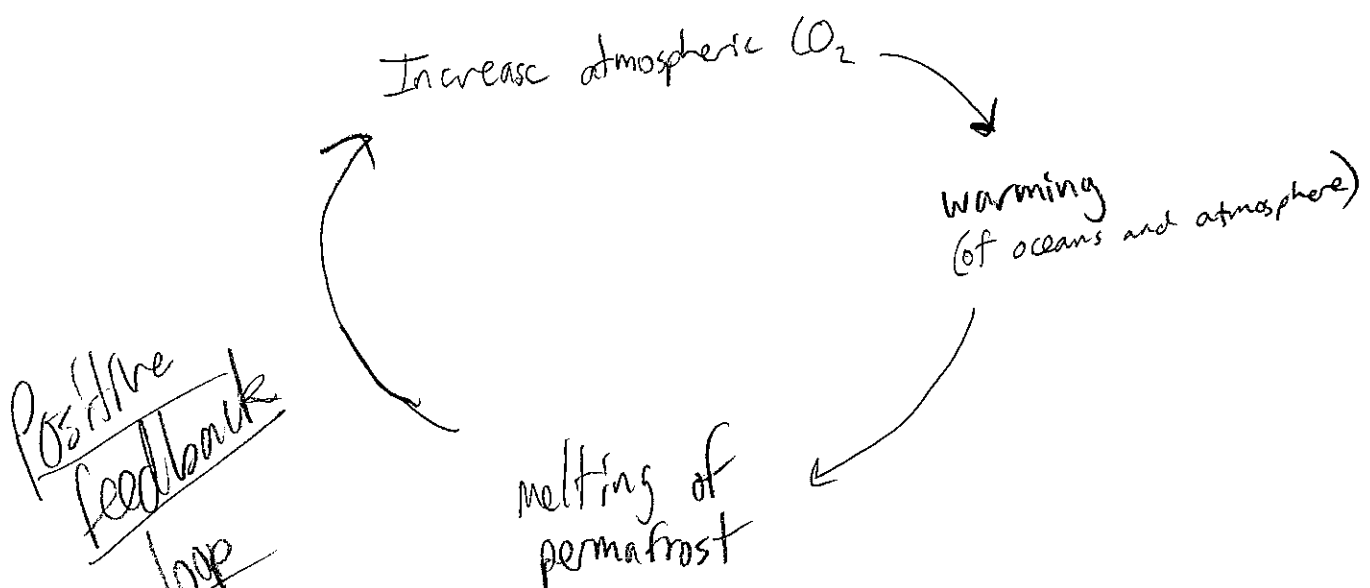
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase of atmospheric carbon dioxide could cause an increase in atmospheric temperature because  $\text{CO}_2$  is a greenhouse gas that traps in heat. This could lead to the warming of the oceans. As the water warms, it cannot hold as much chemicals as cold water, and the make up of the water changes. As the water warms, it cannot absorb as much material so the acidity of the oceans is altered.

5



2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

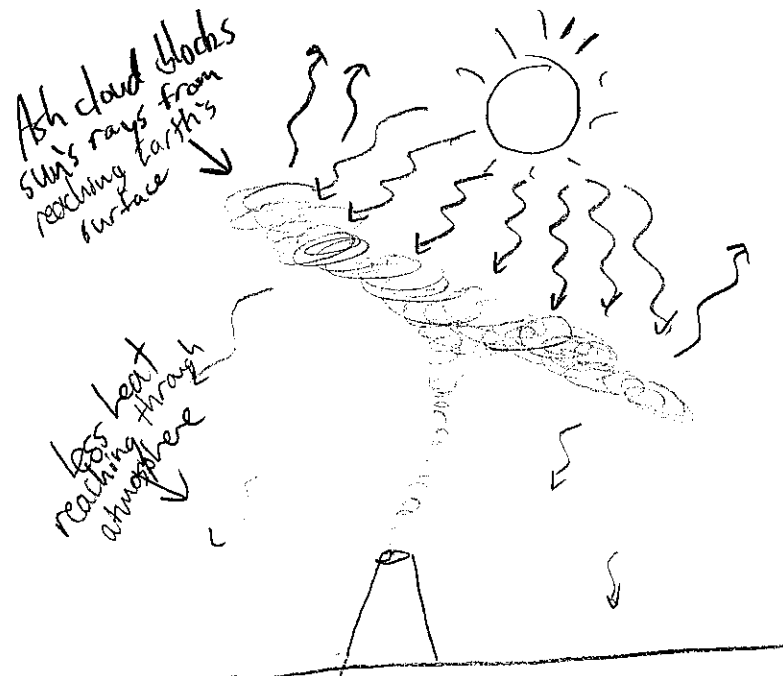
Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect is the ~~layer~~ in our atmosphere that allows Earth to be kept at an appropriate temperature by trapping some heat inside our atmosphere. Without it, Earth would be extremely cold, and uninhabitable. Large ash clouds could block the sun's rays that keep Earth warm. If volcanism on Earth increased dramatically, our temperature could drop.

2

2



Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Both let off gas into atmosphere, both are naturally occurring processes and drive the cycles here on Earth

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

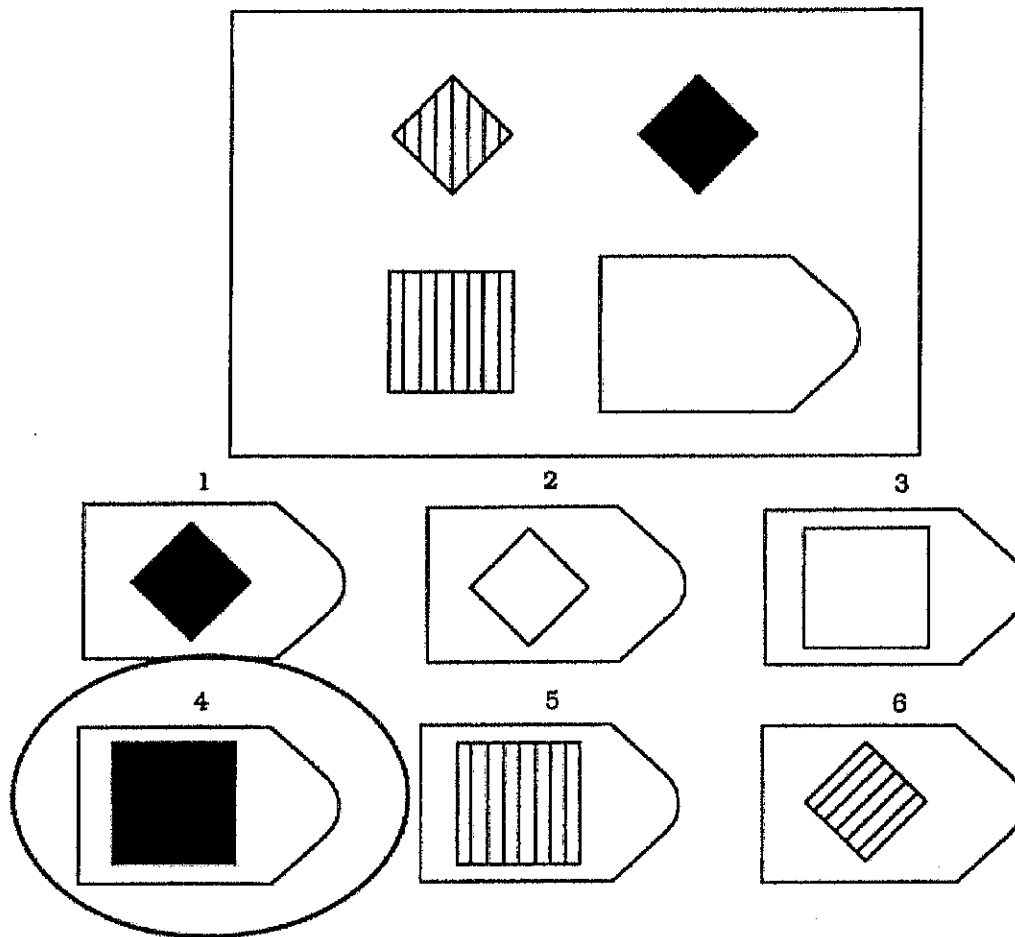
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

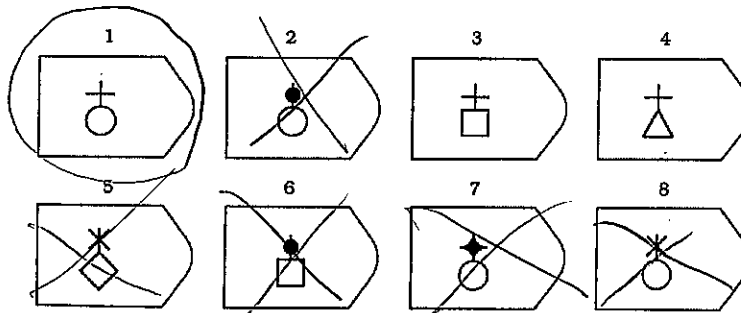
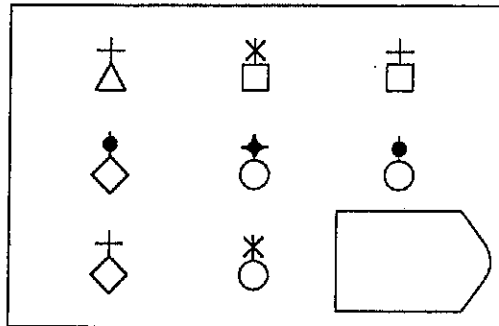


**Answer: 4**

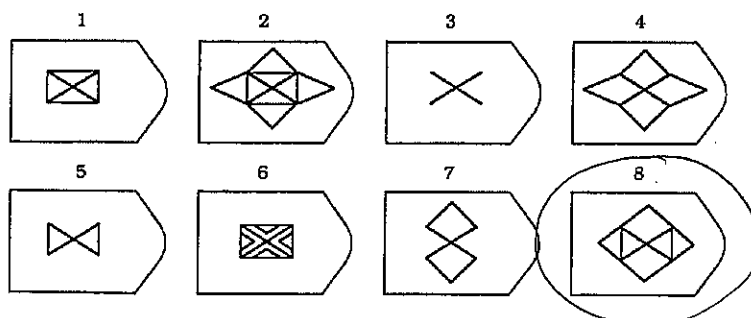
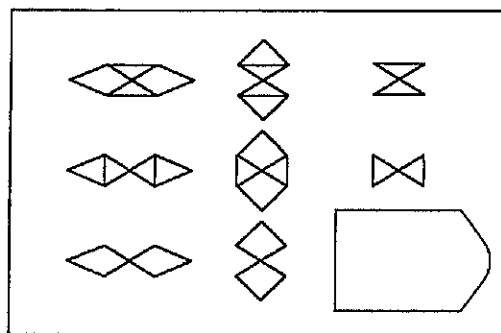
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

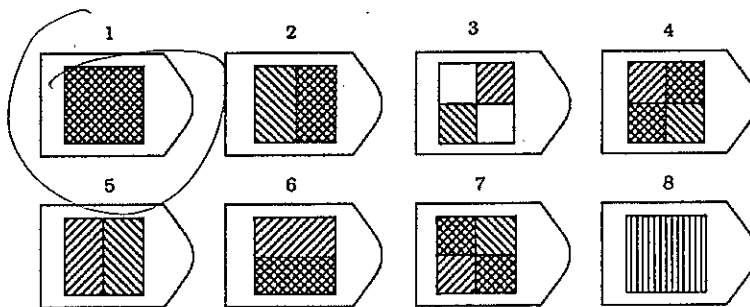
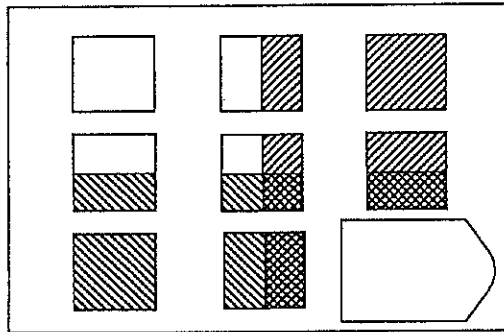
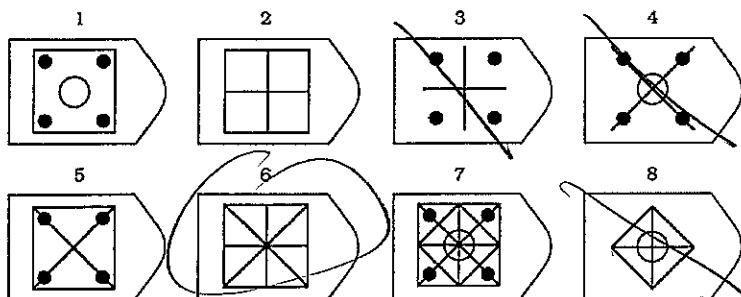
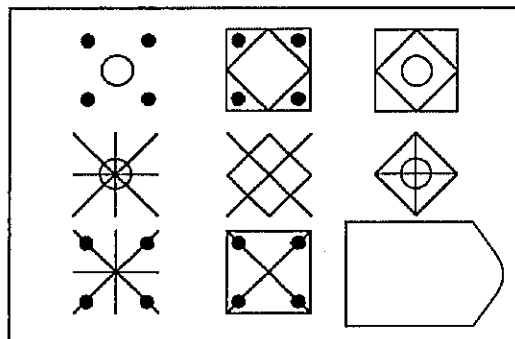


### PATTERN 2

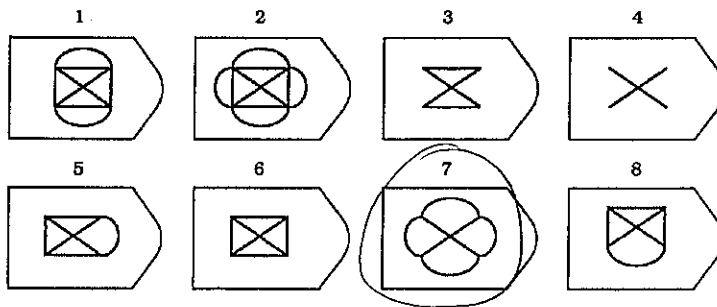
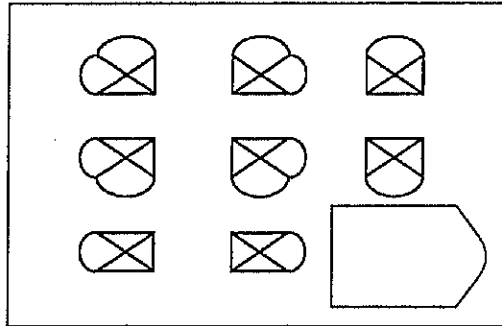


PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

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PLEASE CONTINUE ON NEXT PAGE

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PLEASE CONTINUE ON NEXT PAGE

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- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
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#### DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48189

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A43819247  
Version B

GROUP: C13

57

MULTIPLE-CHOICE. 5 points each (50 points total).

1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ Melting of permafrost resulting in more methane escaping into the atmosphere
  - An increase in evaporation and cloud formation resulting in the release of latent heat
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2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☒ The magma becoming colder
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  - Crystals forming in the magma
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- $RT = \frac{\text{Amount}}{\text{out/in flow}}$
- |  |     |    |
|--|-----|----|
|  | 3   | A  |
|  | 5   | 10 |
|  | 2   | 2  |
|  | 2.5 | 5  |
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ☐ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
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  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
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  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
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## SHORT ANSWER. 25 points each (50 points total)

↑ Temp reduces  $\text{CO}_2$  solubility, as  $T \uparrow$       Acidity

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon Dioxide would increase ocean acidification. Ocean acidification is the absorption of  $\text{CO}_2$  from the atmosphere into the oceans. The oceans absorb  $\text{CO}_2$  from the atmosphere and then the  $\text{CO}_2$  and  $\text{H}_2\text{O}$  in the oceans combine to form Bicarbonate Ions. When temperatures in the oceans rise, acidity is reduced. Rising temperatures in the oceans also cause  $\text{CO}_2$  in the oceans to decrease. Cold water absorbs  $\text{CO}_2$  better than warm water. A positive feedback loop during ocean acidification could be decreasing water temperatures, therefore  $\text{CO}_2$  levels in the oceans would increase, and due to the decreasing temps. the process of ocean acidification would quicken. A negative feedback would be water temperature increase,  $\text{CO}_2$  in the water would decrease, and ocean acidification would be slowed down.

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

An increase in volcanism would increase Earth's atmospheric temperature. Earth's temperature would increase because volcanoes let out  $\text{CO}_2$ , and increasing  $\text{CO}_2$  in the atmosphere, increases atmospheric temperature. When  $\text{CO}_2$  from the volcano is released, greenhouse gases will absorb the  $\text{CO}_2$ . When the  $\text{CO}_2$  is absorbed by G.G. it causes temperatures to rise. G.G. absorb the  $\text{CO}_2$  but also will radiate some of it back to earth's surface. When a volcano erupts, all the magma that is flowing out releases  $\text{CO}_2$  into the air, increasing atmospheric temps. If volcanism on earth is reduced, less  $\text{CO}_2$  will be released into the atmosphere causing atmospheric temperature to decrease and also G.G. would have less  $\text{CO}_2$  to absorb, causing temperature to decrease.

5

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is the transformation of liquid to a gas. Degassing is the transformation of liquid to a gas.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

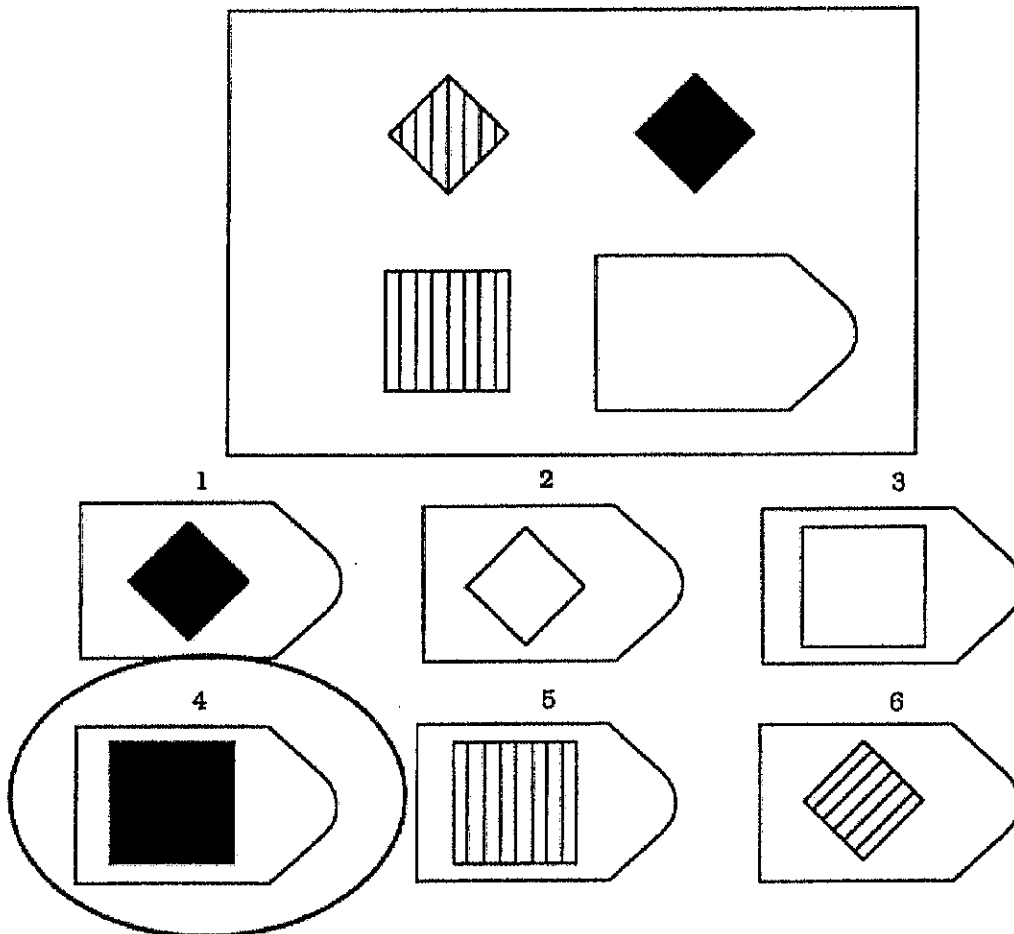


# Analogical Assessment

---

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

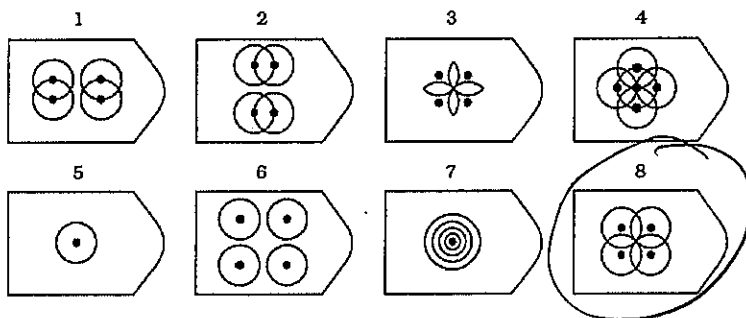
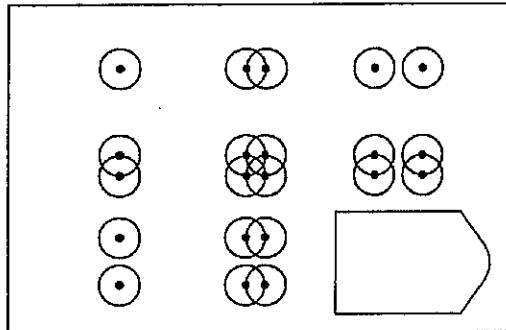


**Answer: 4**

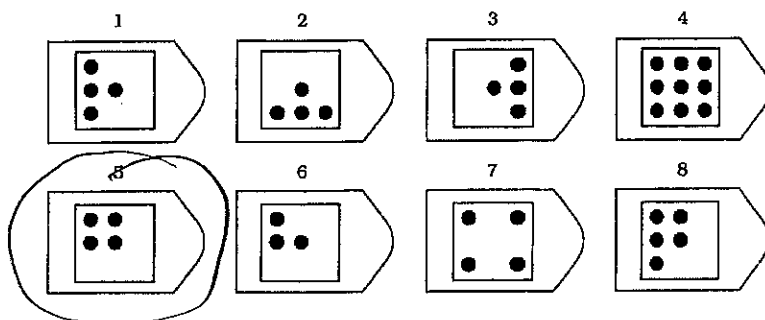
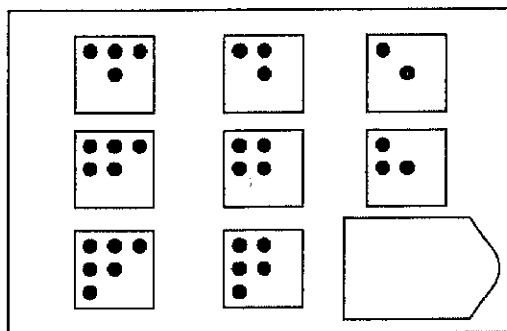
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

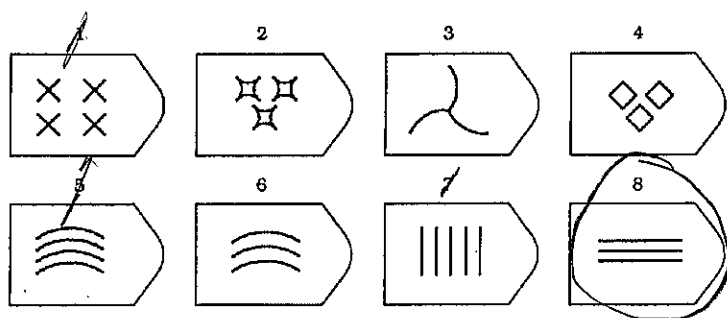
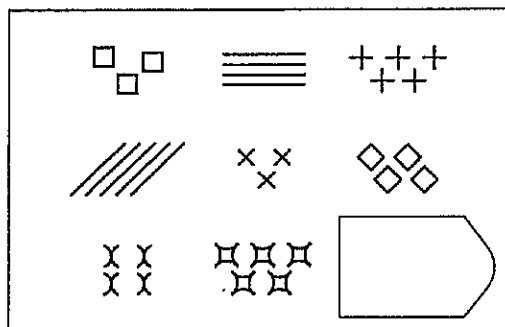
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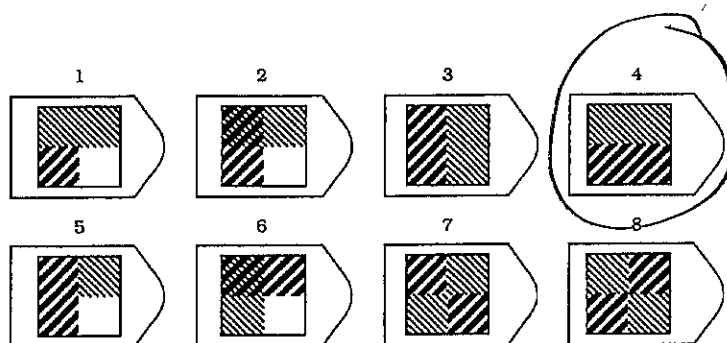
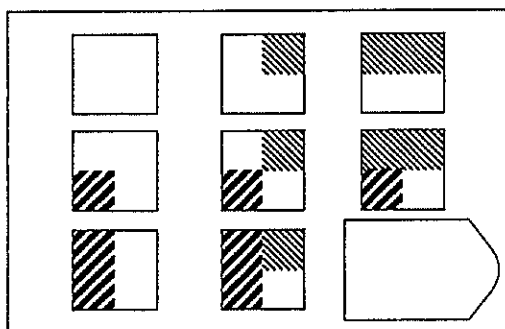
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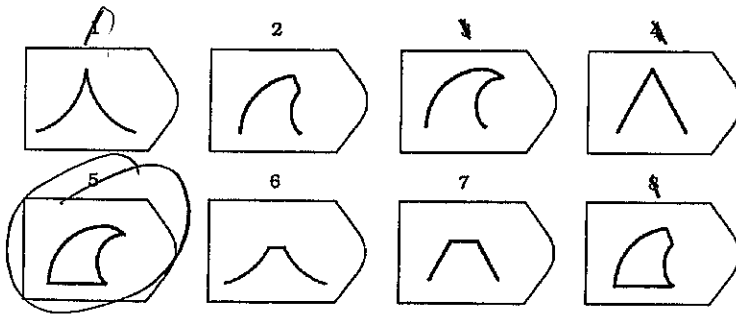
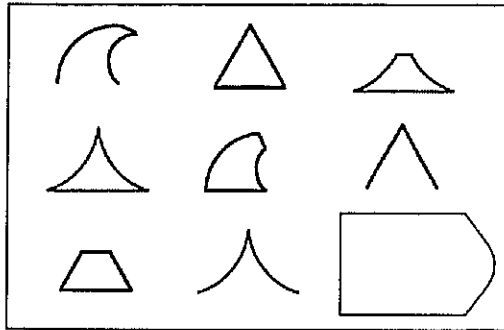


## PATTERN 3



## PATTERN 4



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

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- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

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- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
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- ☒ D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

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- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48009

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 42097647  
Version B

GROUP

C13

55

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- C 1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ~~b. Melting of permafrost resulting in more methane escaping into the atmosphere~~
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- B 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- C 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - ~~b. A= erosion, B= biochemical precipitation, C= uplift and deposition~~
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - ~~d. A= dissolution, B= deposition, C= uplift and deposition~~
- ~~4.~~ Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - ~~d. Neither human activities nor natural processes are important causes of the greenhouse effect.~~
  - ~~e. The human and natural causes of the greenhouse effect are not understood.~~
- B 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- ~~6.~~ Which of the following would cause the acidity of Earth's oceans to decrease?
- ~~a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.~~
  - ~~b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.~~
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

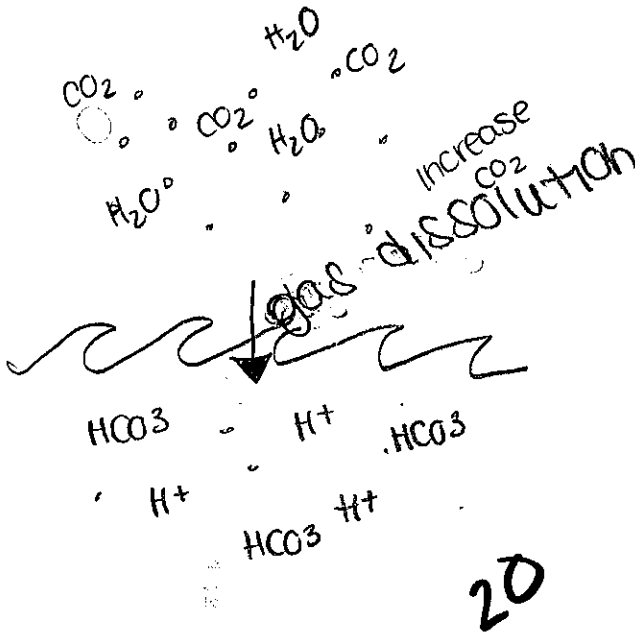
- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- 1000  $\begin{matrix} \leftarrow 100 \\ \rightarrow 50 \end{matrix}$
- a. ~~The reservoir will eventually disappear.~~
  - ☒ b. The reservoir is not in equilibrium.
  - c. ~~The reservoir is growing smaller.~~
  - d. The reservoir's residence time is 10 years.
- A 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - ~~b. The Earth's atmosphere would become warmer than it is today.~~
  - ~~c. The Earth's atmosphere would remain about the same temperature as it is today.~~
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- A 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ~~c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase~~
  - ~~d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease~~
- D 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ~~a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.~~
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ~~c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.~~
  - ☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.



an increase in atmospheric carbon dioxide would affect ocean acidification.

when  $\text{CO}_2$  in the atmosphere combines with  $\text{H}_2\text{O}$  the process of <sup>gas</sup> dissolution into bicarbonate ions and hydrogen ions in the ocean increases the acidity because hydrogen ions alone cause the pH scale in the water to decrease. This can be in the sense of a negative feedback loop by the carbon cycle continuing, back into the lithosphere, biosphere, atmosphere,

and hydrosphere. This can be a positive feedback loop because if the increase of atmospheric  $\text{CO}_2$  becomes a higher influx than outflow in the oceans, the oceans can become too acidic and kill coral reefs, animals, and plants, knocking the carbon cycle off equilibrium.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

This increase of volcanism would decrease Earth's atmospheric temperature. Volcanism is one of the "abrupt" climate changes, when volcanism occurs it releases sulfur into the atmosphere which is an albedo effect. When this happens the sun's radiation is reflected off of the sulfur and radiated back, never being able to be absorbed by either greenhouse gases or the earth or oceans. This is a part of greenhouse effect. For this you need the sun, the earth, and its atmosphere. The sun emits radiation to the earth into the atmosphere, being absorbed by mainly the land and oceans, and reemitted as heat onto the earth. With the sulfur acting as a large reflector, the radiation is reflected back and never allowing the radiation to be emitted as heat, decreasing the temperature.

16

X Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Similar in the sense that they both are being turned into the atmosphere.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

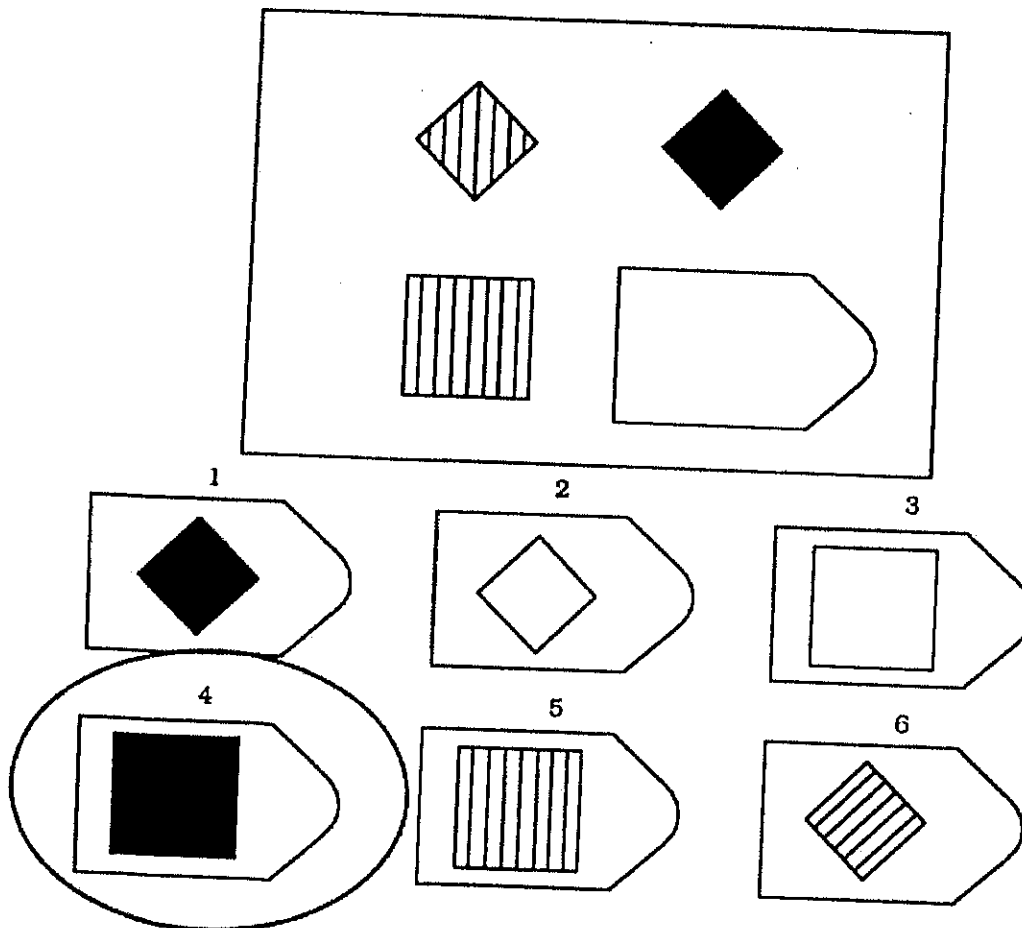
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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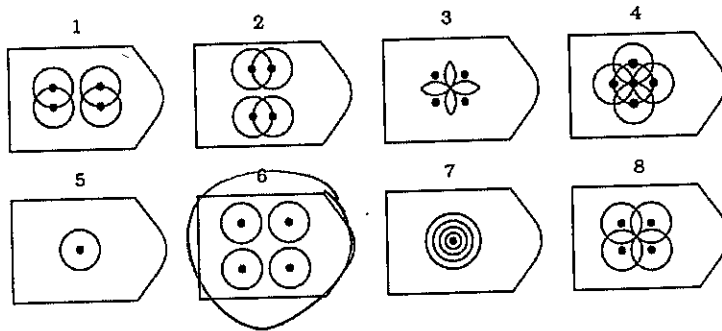
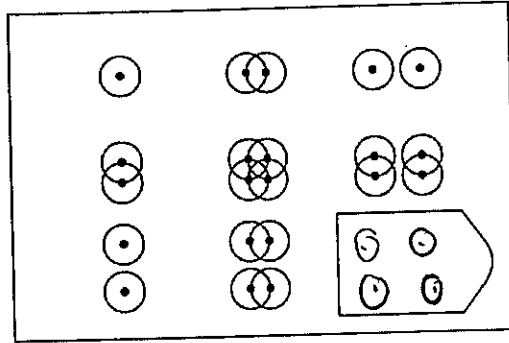


**Answer: 4**

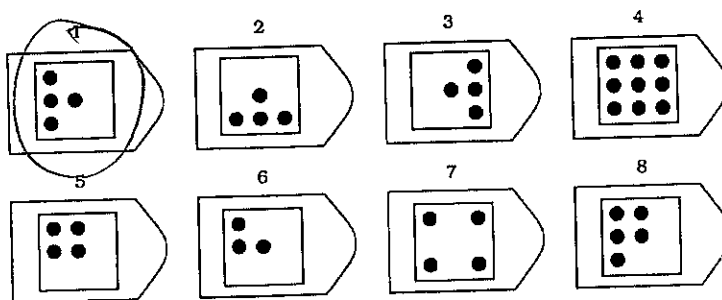
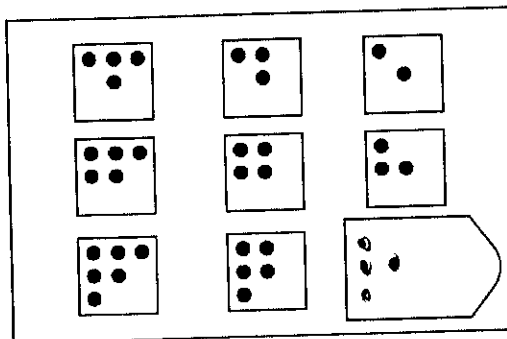
PLEASE CONTINUE ON NEXT PAGE

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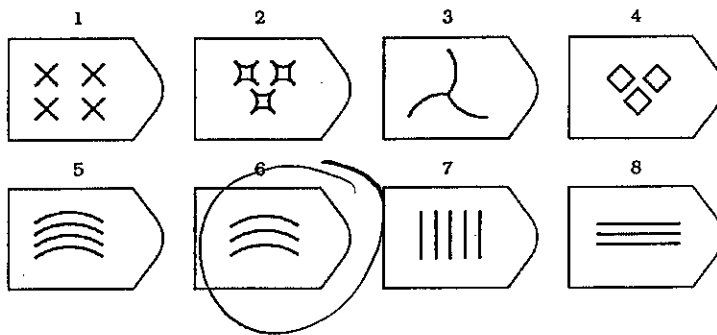
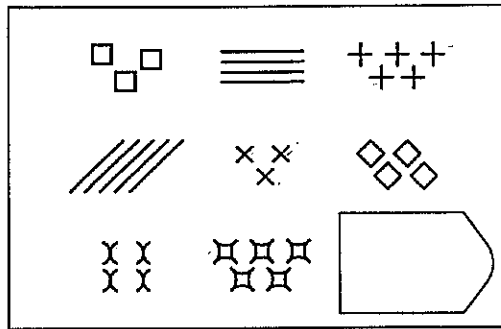


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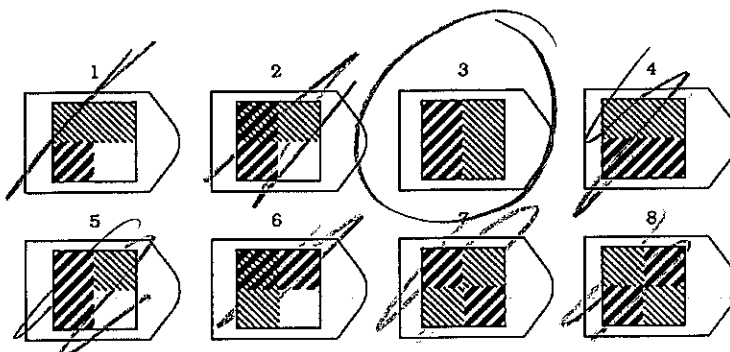
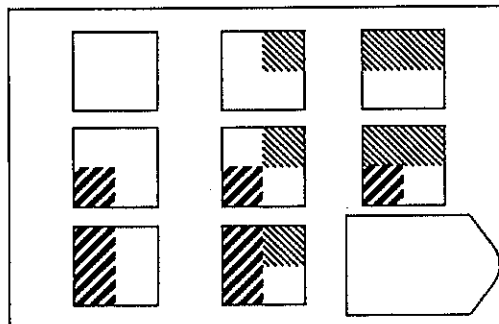


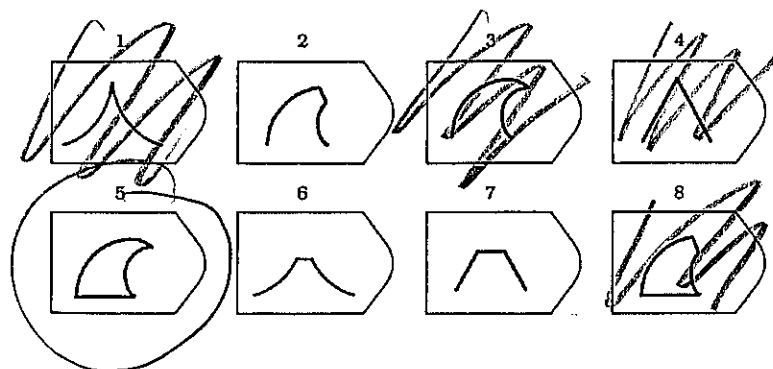
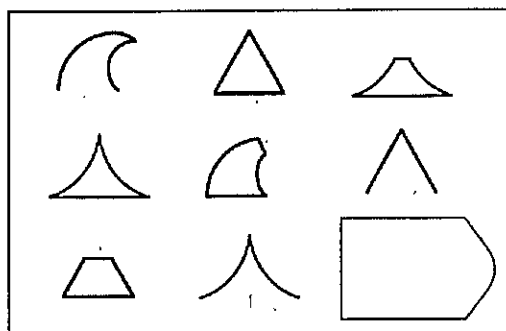


**PATTERN 3**



**PATTERN 4**



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- ☐ African American/Black
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- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A 42957208  
Version B

GROUP: C13

75

**MULTIPLE-CHOICE. 5 points each (50 points total).**

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- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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- a. ☒ Human activities are the primary cause of the greenhouse effect.
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**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

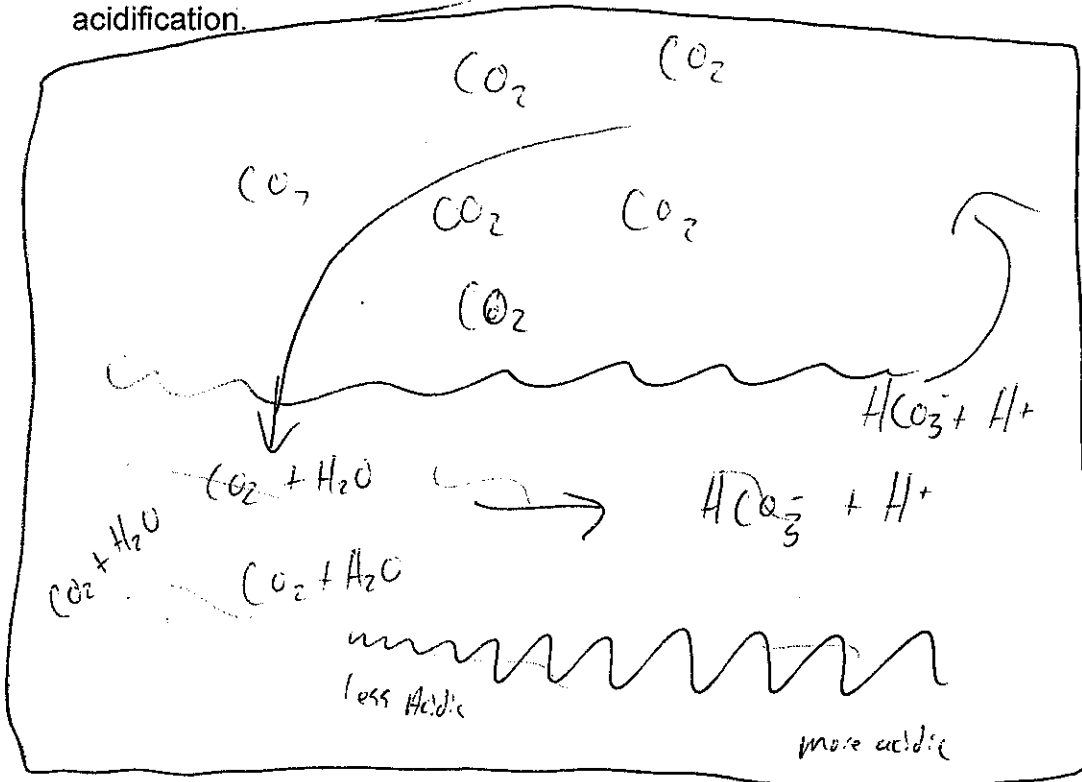
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- A ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - D ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.



An Increase of atmospheric  $\text{CO}_2$  would affect oceans by increasing the pH level and making them more acidic. Atmospheric  $\text{CO}_2$  dissolves into water and creates bonds with water molecules and eventually creates a bicarbonate. This can be a negative feedback loop because with ~~more~~  $\text{CO}_2$  in the air, the greenhouse effect takes place and warms the atmosphere, and the oceans. When oceans get warmer the ocean acidification process dramatically slows down.

? This can also be a positive feedback loop because when the acidic ocean evaporates, it re-emits  $\text{CO}_2$  particles creating more of an influx in the atmosphere, and with more  $\text{CO}_2$  in the atmosphere, it pushes more  $\text{CO}_2$  back in the oceans on a cycle.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Diagram (A)

Without Ash clouds

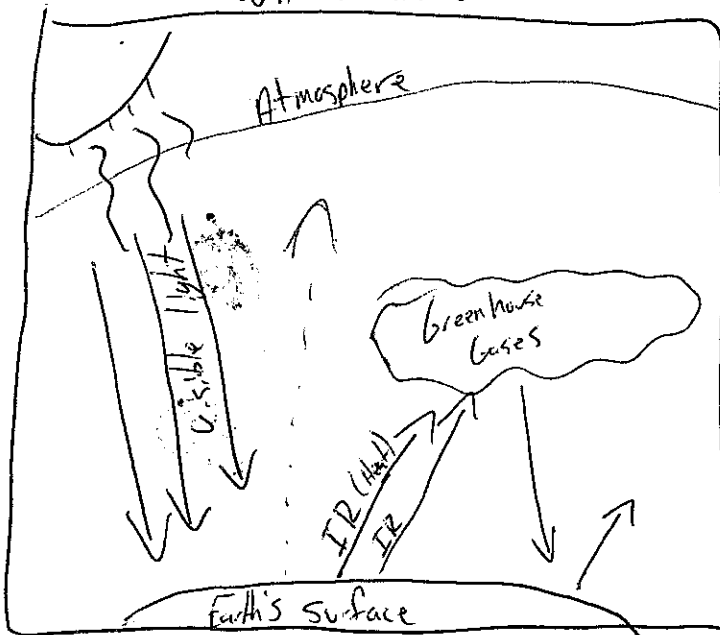
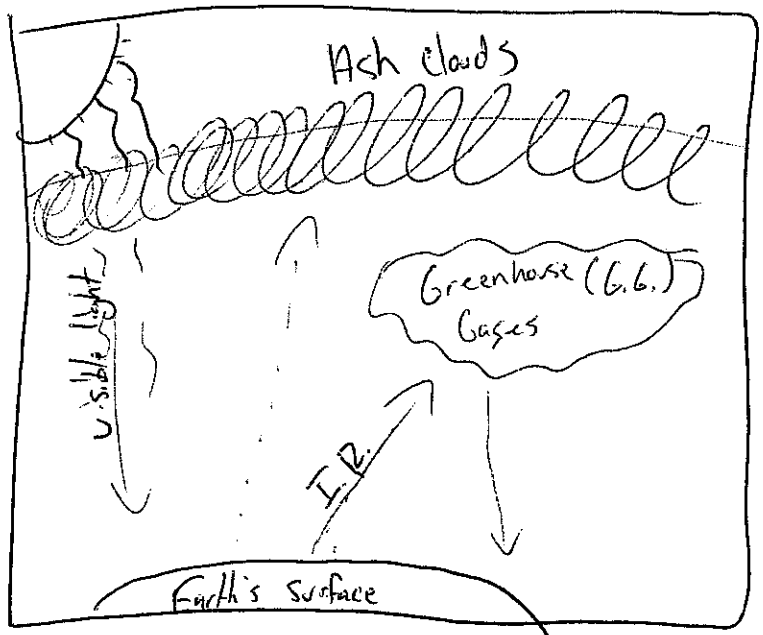


Diagram (B)

With Ash clouds



With an increase in volcanism & Ash cloud cover, the Earth's temperature would decrease. As shown in the diagrams, (A) shows no Ash cover, and most all of the sun's visible light gets through the atmosphere and reaches the Earth's surface. Diagram (B) shows how the Ash clouds prevent visible light from reaching the Earth's surface.

25 - Also, visible light reaching the Earth's surface is significant because of the Greenhouse effect. When light hits the Earth's surface, it gets absorbed and re-emitted as infrared radiation (Heat) and those I.R. rays are absorbed by greenhouse gases, and then it's re-emitted again back to the Earth's surface as heat. So if visible light can't get through to Earth's surface, it won't be re-emitted as I.R. and absorbed by G.G.'s. This is why if volcanism increased, the global temperature would decrease.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation & degassing are similar because they both release a gas into the atmosphere.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

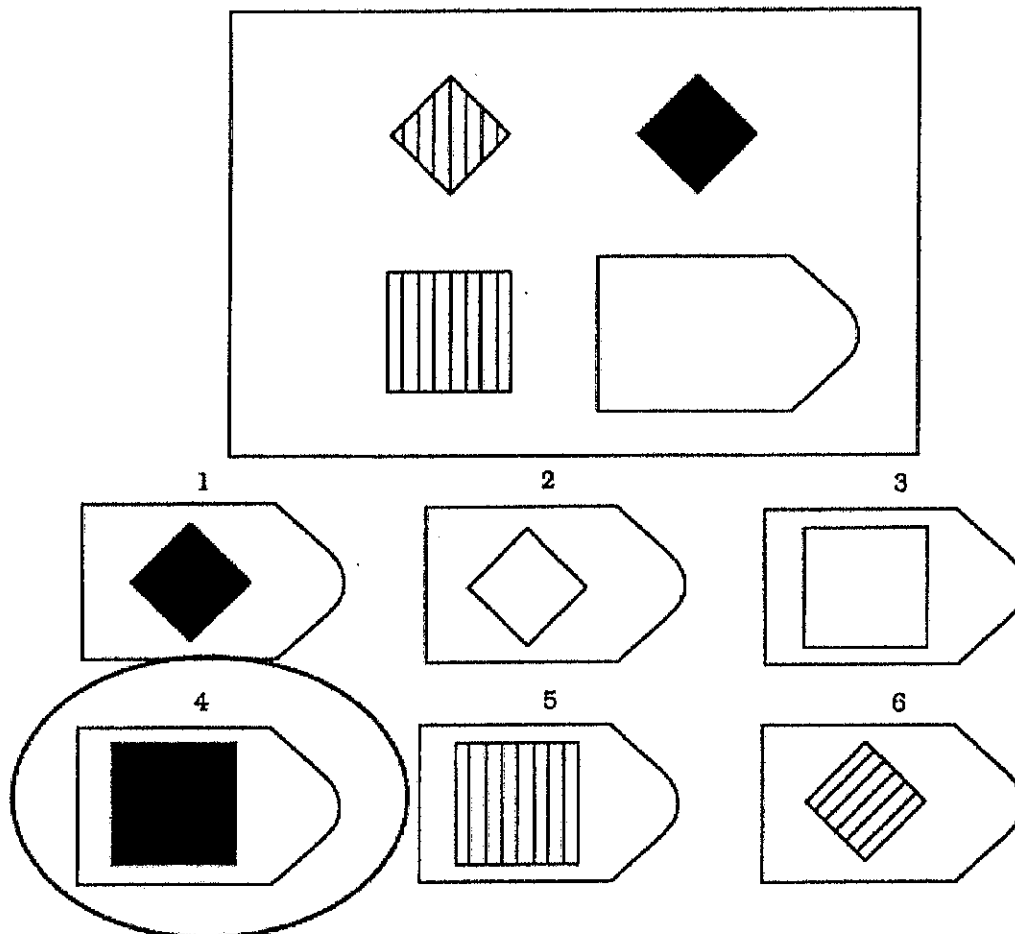
**Thoughtfully complete the attached survey**



# Analogical Assessment

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*Example*

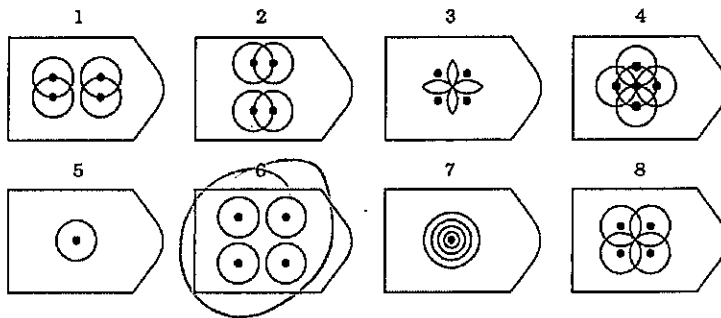
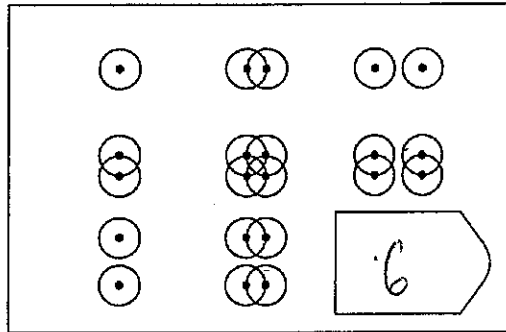
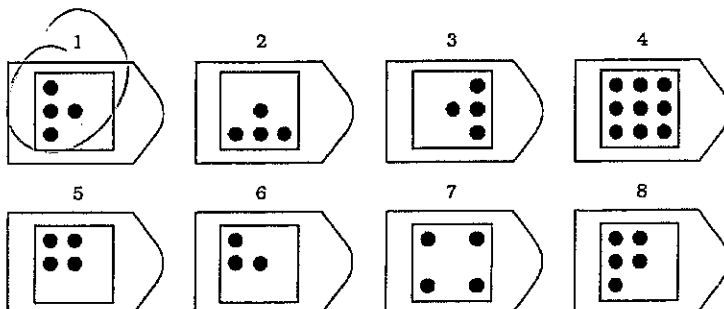
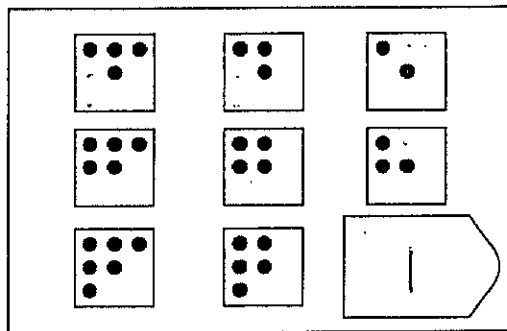


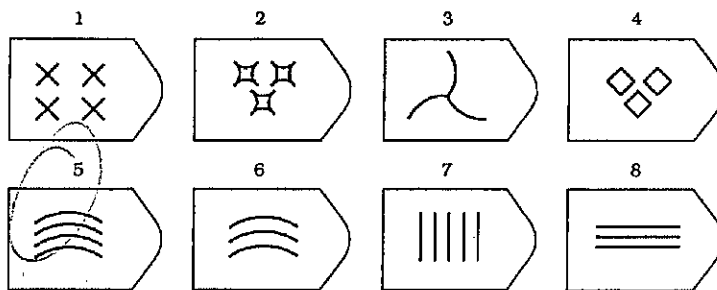
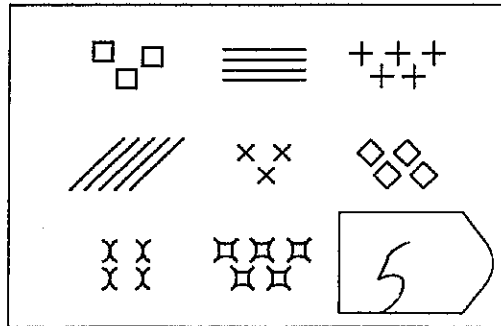
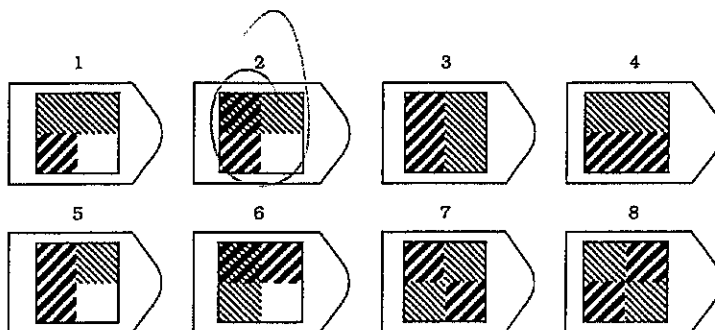
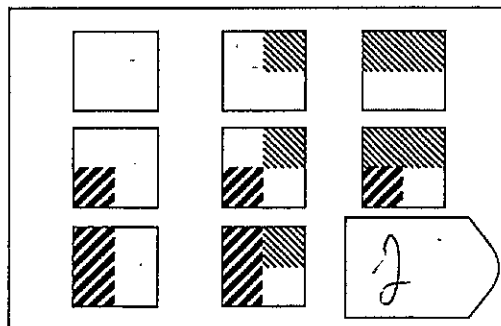
**Answer: 4**

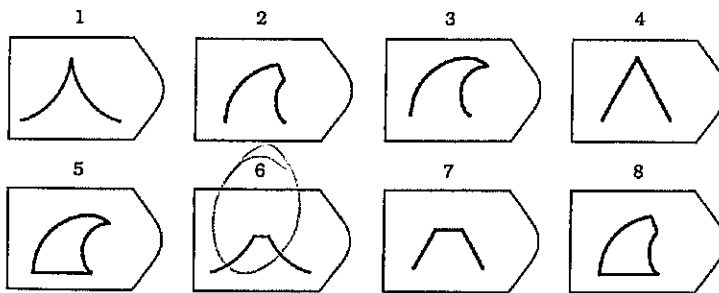
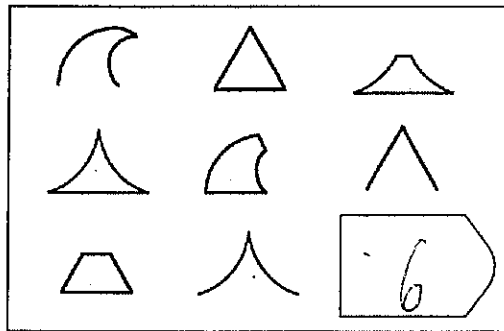
PLEASE CONTINUE ON NEXT PAGE

A42957208

Please choose the image that best completes each of the following patterns.

**PATTERN 1****PATTERN 2**

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
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- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
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- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

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- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48433

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



1

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

**STUDENT NAME:** A 42096024  
Version B

**GROUP:** C13

75

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
  
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
  
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
  
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
  
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
  
6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- The reservoir will eventually disappear.
  - ☒ The reservoir is not in equilibrium.
  - The reservoir is growing smaller.
  - The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ The Earth's atmosphere would become colder than it is today.
  - The Earth's atmosphere would become warmer than it is today.
  - The Earth's atmosphere would remain about the same temperature as it is today.
  - The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ Reflection of more solar radiation, causing atmospheric temperature to decrease
  - Reflection of more solar radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would increase the amount of  $\text{CO}_2$  in the ocean. The ocean is merely one reservoir for the planet's  $\text{CO}_2$ , so an increase in one ultimately spills over to an increase in another, through the process of deposition,  $\text{CO}_2$  from the atmosphere enters into the ocean. A negative feedback loop of ocean acidification is a decrease in the greenhouse effect, allowing more  $\text{CO}_2$  to escape, and thus lose and lose  $\text{CO}_2$  in the oceans. A positive feedback loop is the increase of the greenhouse effect, resulting in exponentially more  $\text{CO}_2$  entering into the oceans.

20

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

20x comp  
When a volcano explodes, not only does it spew lava, but also ash. The ash soars into the atmosphere and lingers for quite some time. While in the atmosphere, said ash blocks solar light from fully reaching the Earth, resulting in decreasing temperatures. Usually the light is allowed to <sup>fully</sup> penetrate the atmosphere, eventually having most of it bounce back into space. When it is not fully allowed to bounce back into space, (because of greenhouse gas,) the temp rises. Thus, the temp would initially rise because of trapped radiation, but ultimately plummet due to blocked solar radiation.

15

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing both deal with materials going from a liquid to a gas. Evaporation deals with water, and degassing deals

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

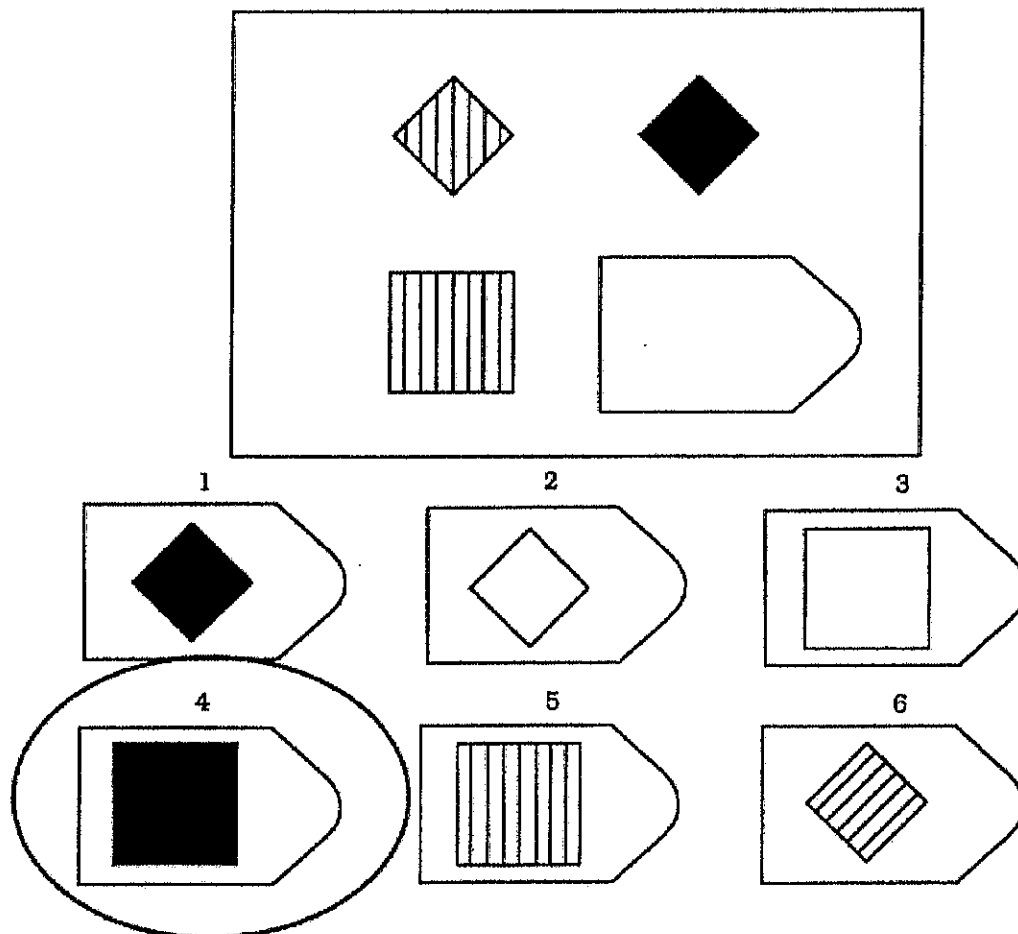
**Thoughtfully complete the attached survey**



# Analogical Assessment

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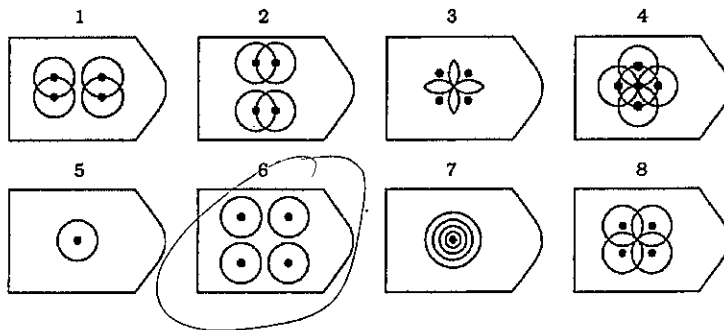
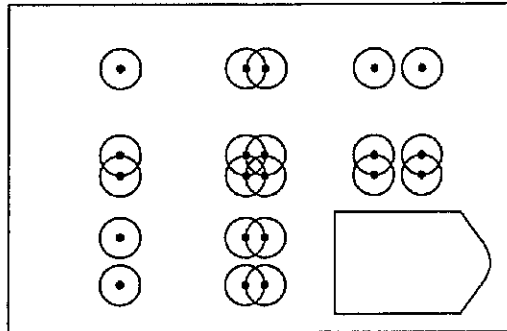


**Answer: 4**

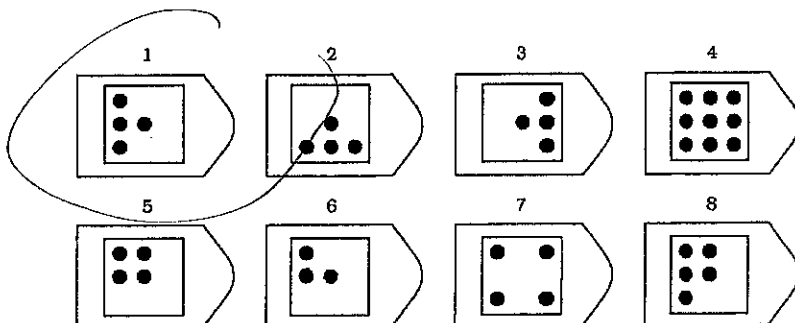
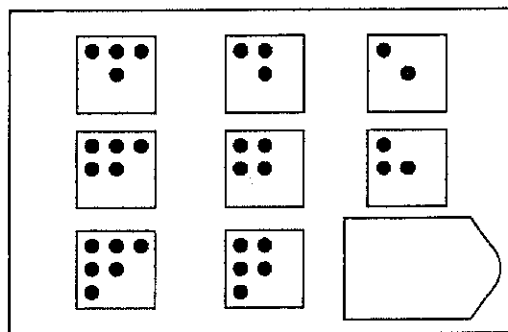
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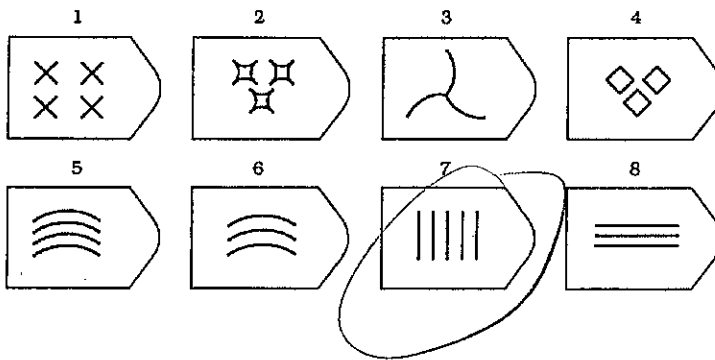
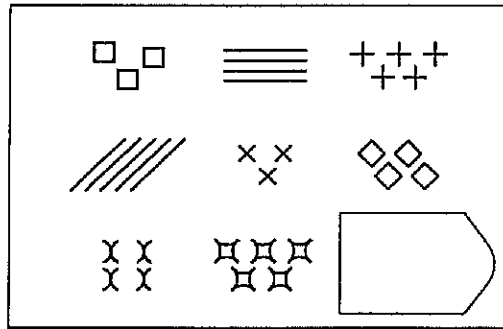
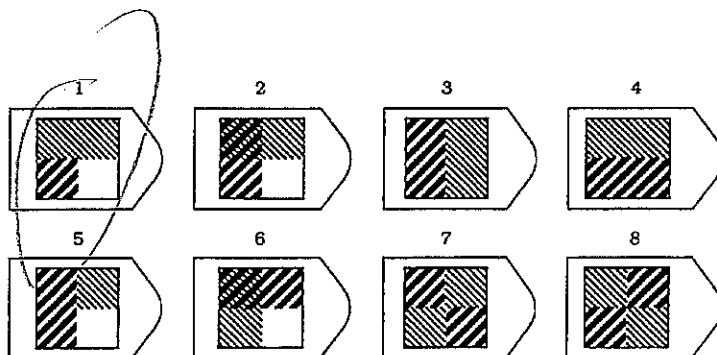
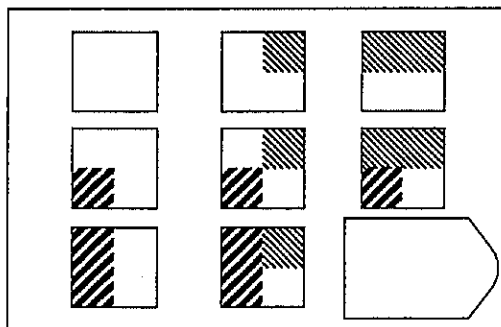
### PATTERN 1

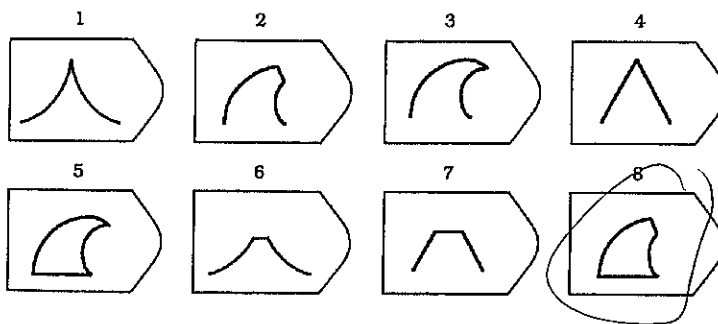
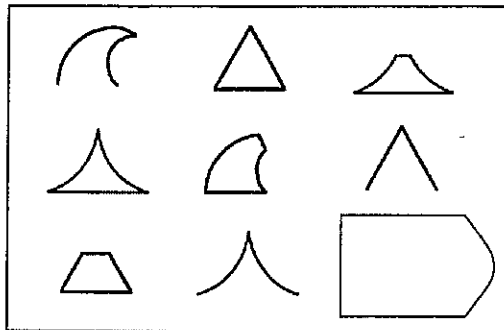


### PATTERN 2





**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

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PLEASE CONTINUE ON NEXT PAGE

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PLEASE CONTINUE ON NEXT PAGE

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## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48471

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A42123279  
Version B

GROUP: C13

40

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
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4. Which of the following statements about the greenhouse effect on Earth is most accurate?
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- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
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  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is a process in which these large water reservoirs acquire hydroxide ions, which changes the acidity. If there were an increase in atmospheric  $\text{CO}_2$  (Greenhouse Gas), overall atmospheric temp. would increase. When  $\text{CO}_2$  reacts with water (ocean), ions are released ( $\text{HCO}_3^-$  and  $\text{H}^+$ ), causing ocean acidification to increase. This is an example of a positive feedback loop. A negative feedback loop would be the formation of more clouds (from higher Atmospheric temp.), which releases latent heat into space, which decreases atmospheric temp., which results in a decrease of ocean acidification.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Large ash clouds from volcanoes act very similarly to a normal cloud in the atmosphere. For example, when the sun emits solar radiation towards Earth on a clear day, Atmospheric temperature will increase because greenhouse gasses re-emit the rays back to Earth. This is not the case if a cloud, whether water or volcanic, is blocking the sun's radiation. The initial emission from the sun is blocked, or reflected, by the ash clouds. This means less radiation to be re-emitted by greenhouse gasses in the atmosphere, and less latent heat. Atmospheric temperature would decrease.

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different?



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

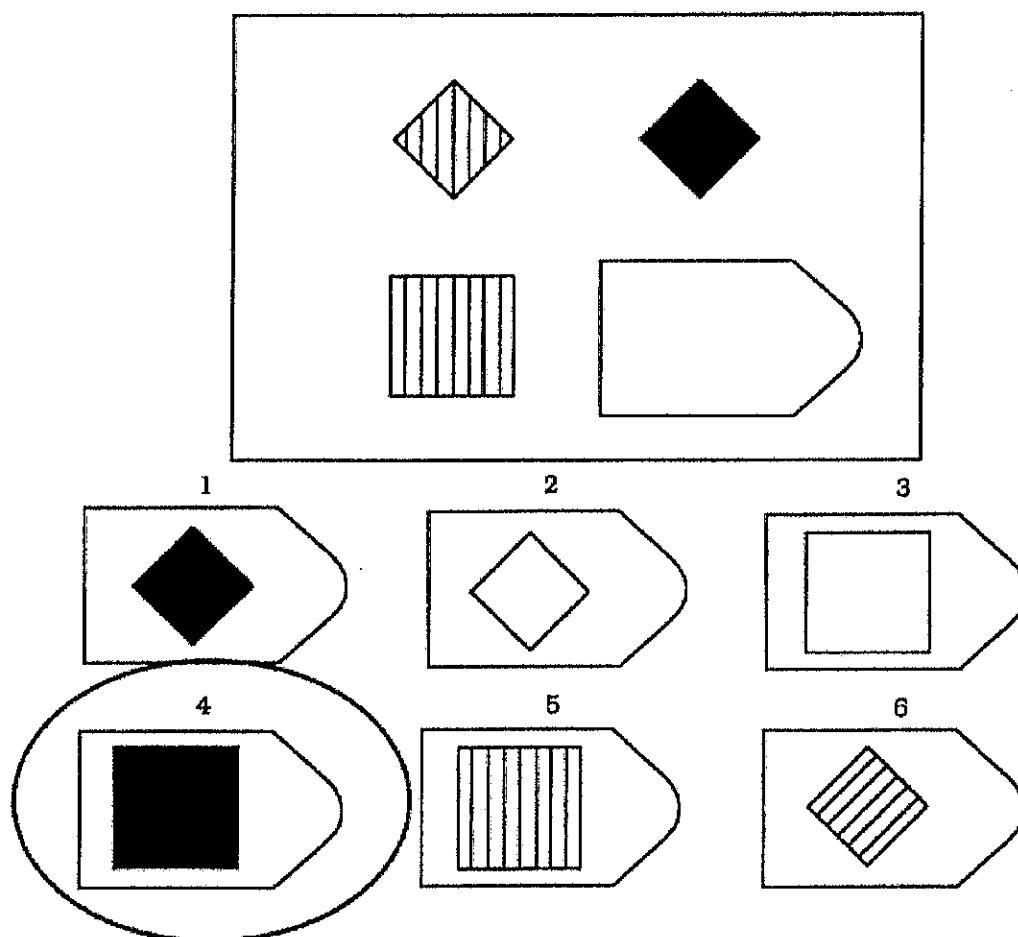
**Thoughtfully complete the attached survey**



# Analogical Assessment

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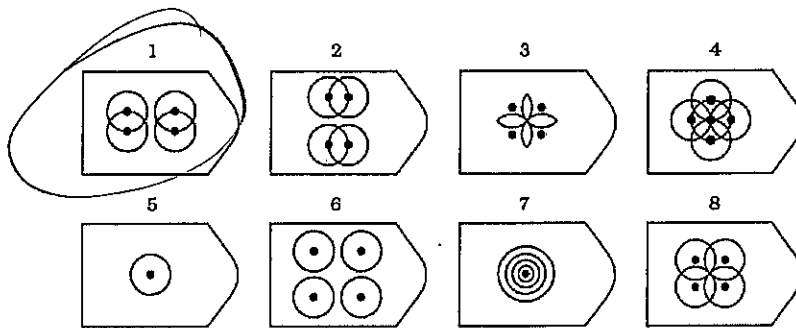
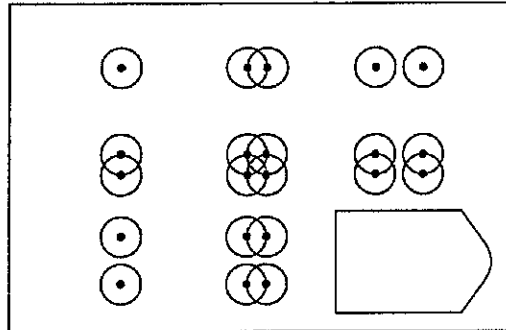


**Answer: 4**

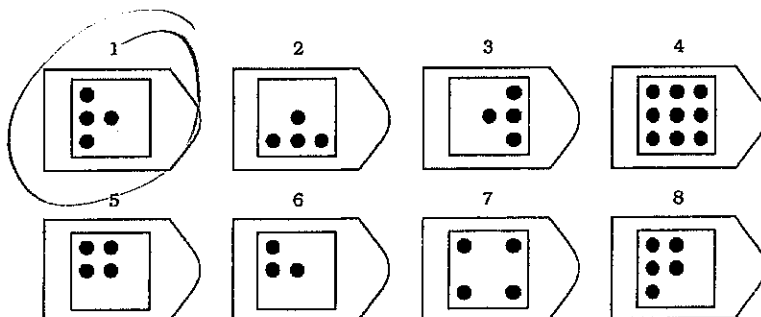
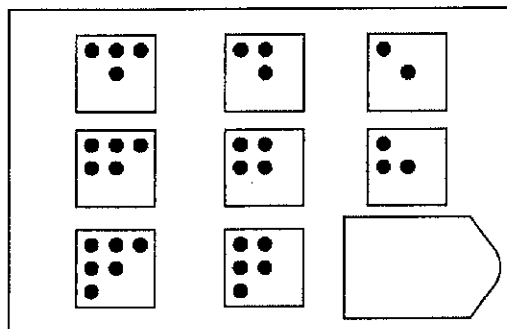
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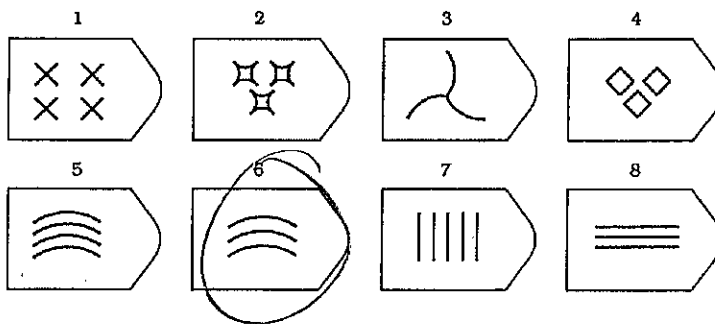
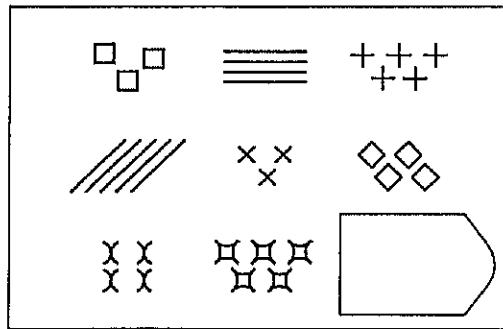
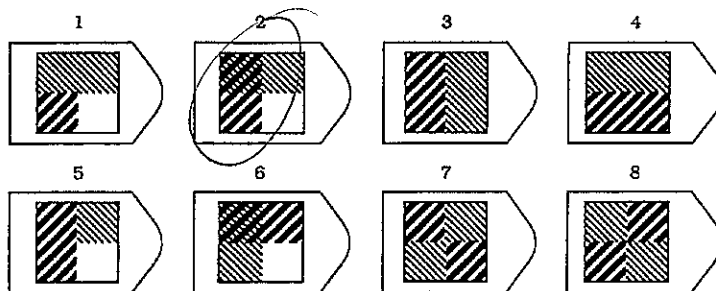
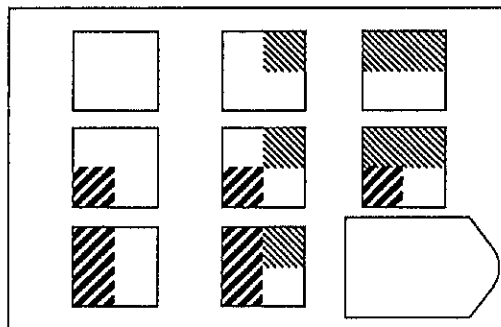
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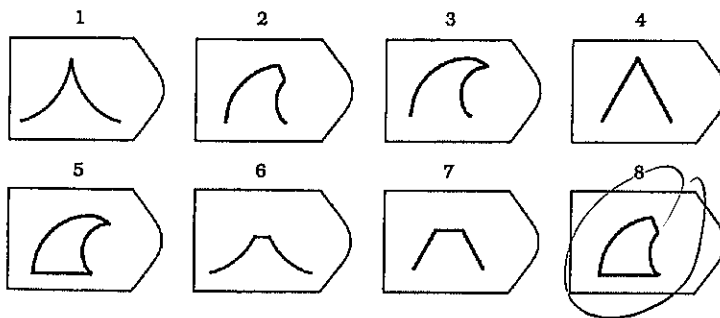
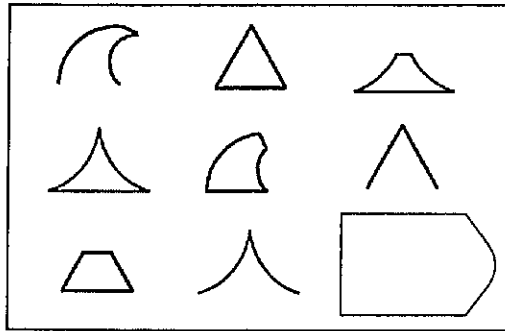
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

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1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

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☒ C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

☒ D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

☒ B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

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D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

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☒ B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

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B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

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- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
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- ☐ D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

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- ☐ C. Being sleep deprived. They both involve impaired functions.
- ☐ D. Eating too much candy. They both involve lack of self-control.
- ☐ E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☐ A. Dew forming. They are similar because they both involve a drop in temperature.
- ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☐ C. Clouds forming. They are similar because they both involve a phase change.
- ☐ D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48169

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☐ Caucasian
- ☒ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



1

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

**STUDENT NAME:** A43376720  
Version B

**GROUP:** C14         

62

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?  
☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere  
☐ c. An increase in evaporation and cloud formation resulting in the release of latent heat  
☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
  
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
☐ a. The magma becoming colder  
☒ b. Gas bubbles forming in the magma  
☐ c. The surrounding crust becoming hotter  
☐ d. Crystals forming in the magma
  
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of   A  . Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of   B   and compaction, and then limestone becomes exposed at Earth's surface through the processes of   C  .  
☐ a. A = erosion, B = deposition, C = uplift and erosion  
☐ b. A = erosion, B = biochemical precipitation, C = uplift and deposition  
☒ c. A = dissolution, B = biochemical precipitation, C = uplift and erosion  
☐ d. A = dissolution, B = deposition, C = uplift and deposition
  
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
☐ a. Human activities are the primary cause of the greenhouse effect.  
☒ b. Natural processes are the primary cause of the greenhouse effect.  
☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
☐ e. The human and natural causes of the greenhouse effect are not understood.
  
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
☐ a. Reservoir A has a shorter residence time than Reservoir B.  
☒ b. Reservoir B has a shorter residence time than Reservoir A.  
☐ c. Reservoir A and Reservoir B have equal residence times.  
☐ d. More information about Reservoir A and Reservoir B is needed.
  
6. Which of the following would cause the acidity of Earth's oceans to decrease?  
☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
☐ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

✓

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- ☐ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - ☐ b. The Earth's atmosphere would become warmer than it is today.
  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is caused by temp. the warmer it is the more acidic the ocean is.  $\text{CO}_2$  in the atmosphere helps to raise and lower the temp. Putting more  $\text{CO}_2$  in the atmosphere would cause there to be more greenhouse gases in the atmosphere. This would mean more light from the sun is getting trapped in the earth's atmosphere & turning into infrared. This cause the earth's temp to rise and therefore the ocean temp to rise as well. With the increase in atmospheric  $\text{CO}_2$  there would be a positive feedback loop because more  $\text{CO}_2$  would cause a higher temp and higher ocean acidification. This would be a positive instead of negative feedback loop because the result of increasing atmospheric  $\text{CO}_2$  would cause the cycle to continue on in a way that brings the same outcome as before.

not  
clear

15

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

With an increase in volcanism and therefore larger ash clouds in the atmosphere this would cause a decrease in the amount of sunlight that is able to reach the earth's surface. This would affect the greenhouse effect in that with less sunlight coming in there is less sun that is being reflected off the surface of the earth, with the ultraviolet light continuing back into space, and the infrared rays getting caught in the greenhouse gases and bouncing back to the earth's surface which would heat up the earth and cause the temp. to rise. This means that the temp of the earth would decrease because not enough infrared get to the earth through the layer of cloud which is a big step in helping to increase temp.

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

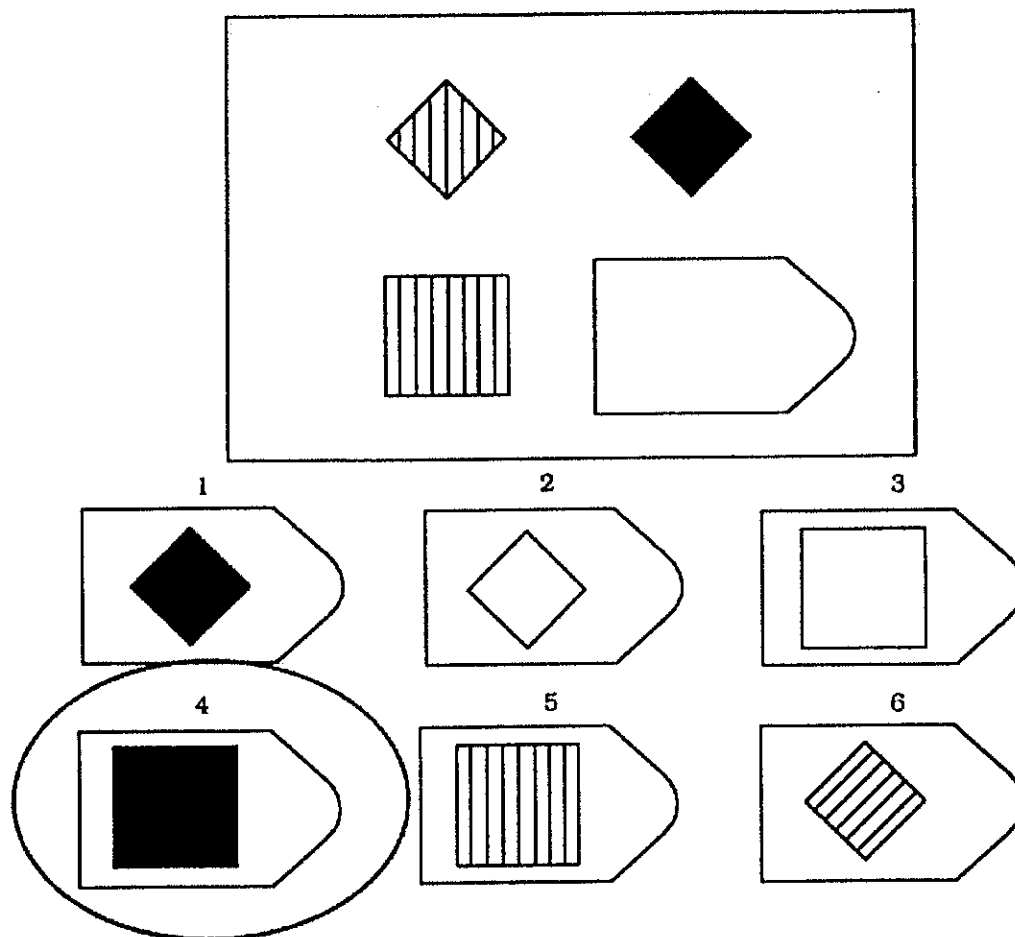
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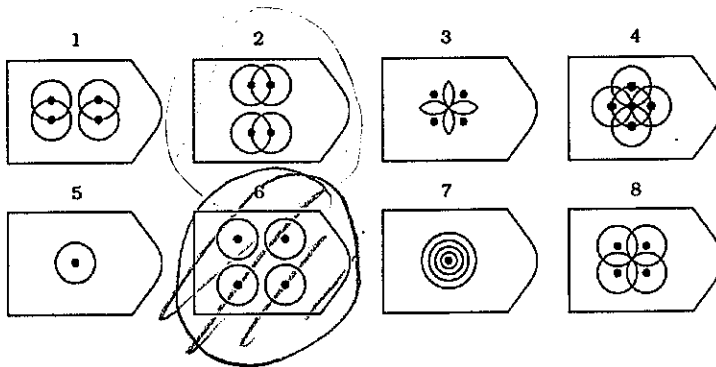
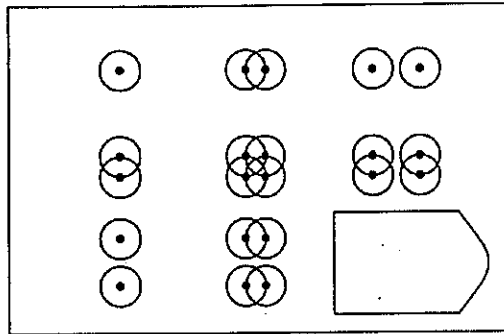


**Answer: 4**

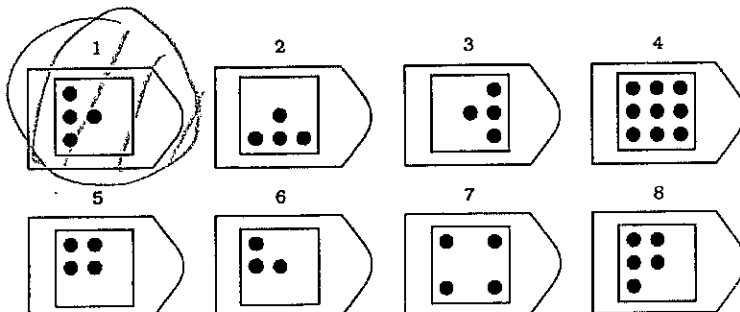
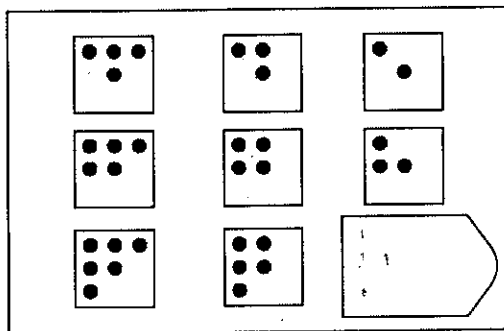
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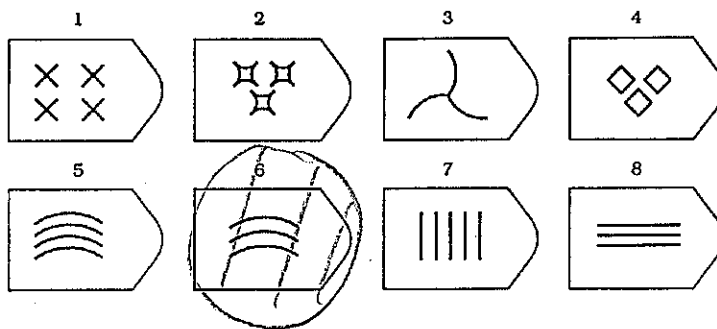
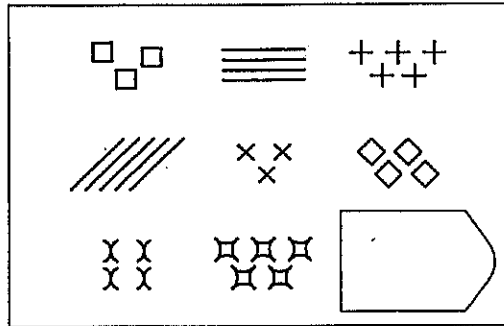
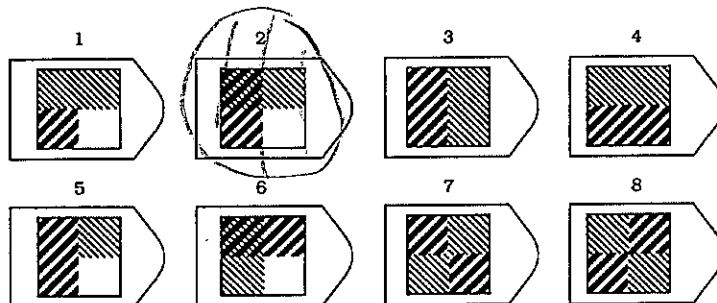
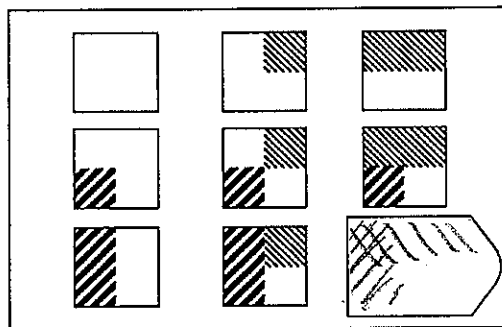
### PATTERN 1

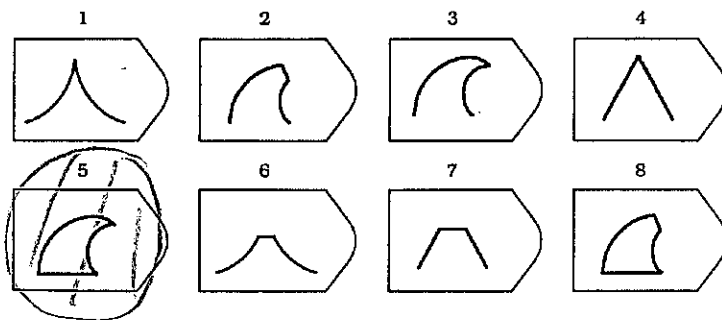
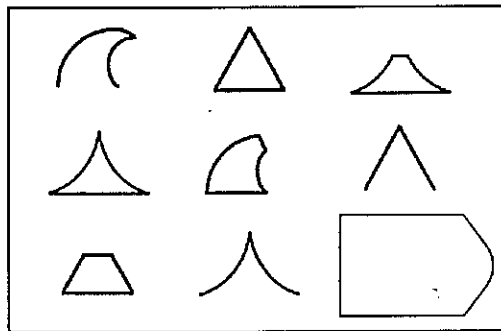


### PATTERN 2





**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

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PLEASE CONTINUE ON NEXT PAGE

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D. Building a house. They are similar because they both involve building a structure.

### DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 49306

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A43424499  
Version A

GROUP: C14

38

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
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  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
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  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - ☒ c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- B 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- C 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- A 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

A) Ocean acidification is the process which takes place when  $\text{H}_2\text{O}$  reacts with  $\text{CO}_2$ . It is part of the carbon cycle. When there is more carbon in the atmosphere, more  $\text{CO}_2$  will be absorbed by the water. When it is with the water, the water's pH level rises because  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$

B) Positive feedback loops take place when there is more carbon in the atmosphere because more  $\text{CO}_2$  is absorbed by  $\text{H}_2\text{O}$ . An example is having more biochemical precipitation.

An example of a negative feedback loop is having more  $\text{CO}_2$  in the  $\text{H}_2\text{O}$  causing it to be more dense than normal  $\text{H}_2\text{O}$

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to ~~volcanism~~ that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

A) The greenhouse effect is the process in which radiation from the sun is reflected (and some absorbed) from the earth's surface. The radiation is then partially absorbed by the greenhouse gases and warms the atmosphere. The radiation absorbed by the greenhouse gases is infrared light.

- Volcanoes erupting causes ash to enter the atmosphere which thickens the gases in the atmosphere (ash clouds). When more volcanoes erupt, there are more ash clouds. These clouds decrease the Earth's atmospheric temperature because the sun's radiation cannot get past the greenhouse gases / ash clouds.

B) Greenhouse gases cause global warming AND global cooling, but the ash clouds will block the sun's radiation causing a decrease in atmospheric temperature.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

similar

Both involve gases being released from source into the atmosphere

differences

1. evaporation is only liquid to gas
2. degassing involves one being released during



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

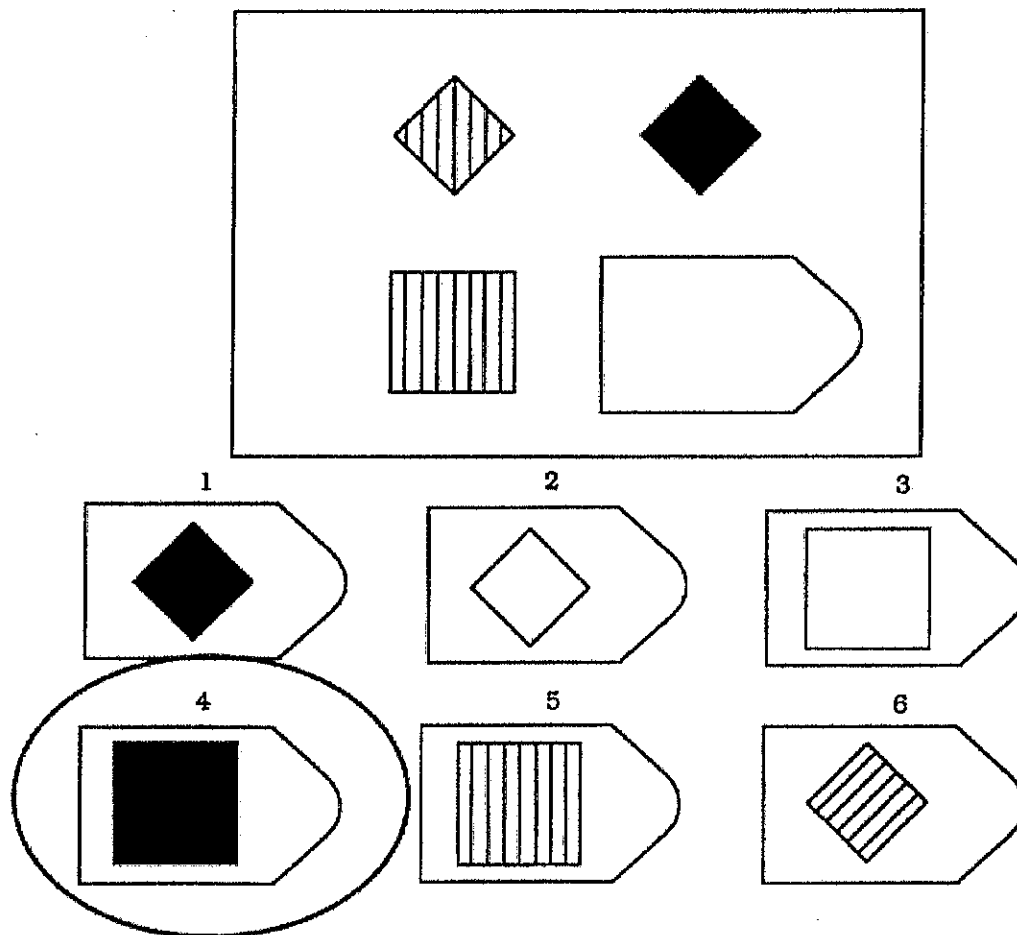
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

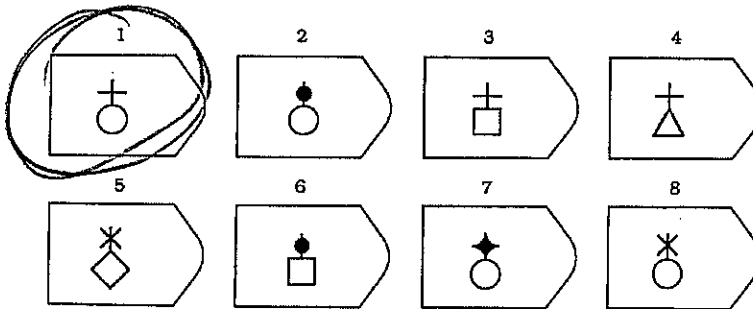
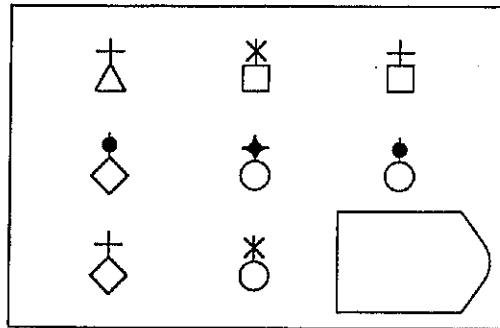


**Answer: 4**

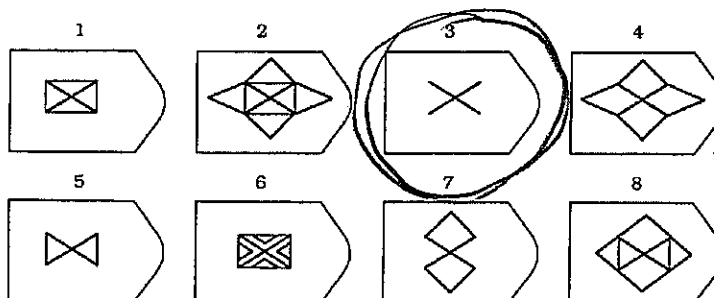
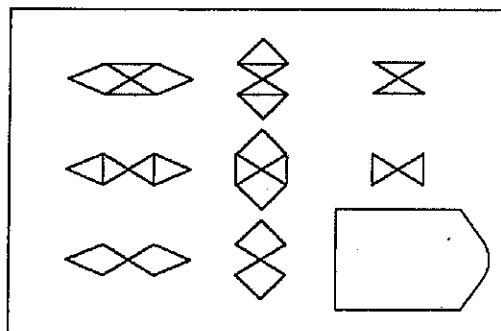
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

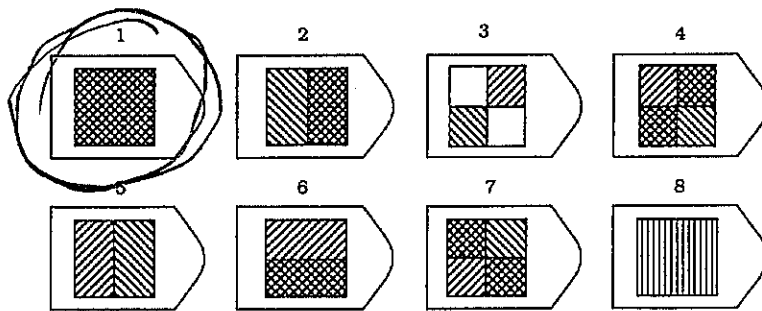
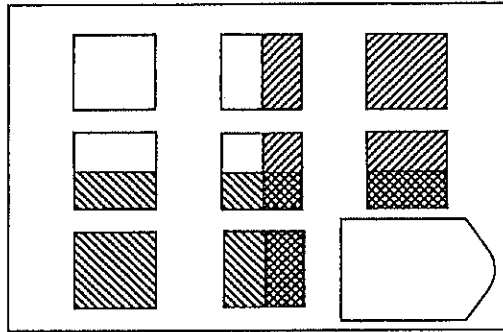


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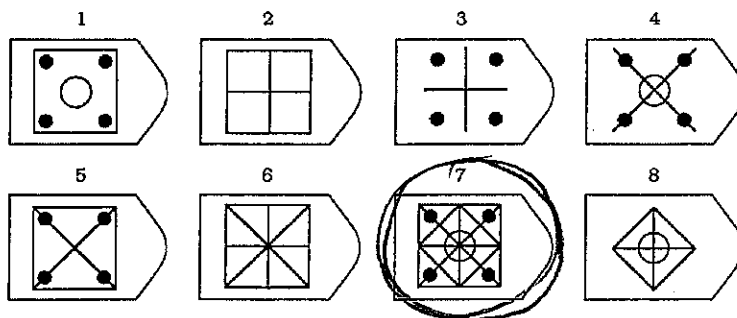
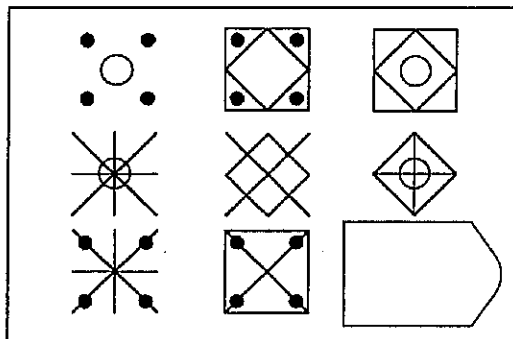


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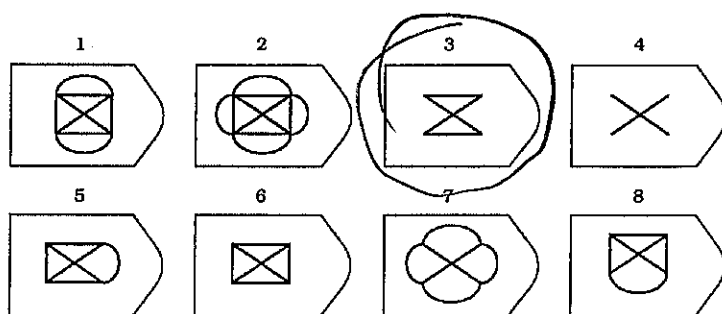
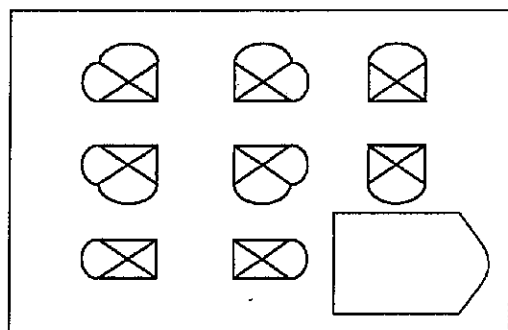
## PATTERN 3



## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.
  - A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
  - B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
  - C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
  
2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.
  - A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
  - B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
  - C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
  - D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.
  
3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.
  - A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
  - B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
  - C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
  - D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.
  
4. The rival gangs used graffiti to define their territorial boundaries.
  - A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
  - B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
  - C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
  - D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48823

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☒ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other



STUDENT NAME: A 3922014  
Version A

GROUP: C14

55

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☒ a. The magma becoming colder
- ☐ b. Gas bubbles forming in the magma
- ☐ c. The surrounding crust becoming hotter
- ☒ d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- ☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
- ☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere
- ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
- ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☐ a. A= erosion, B= deposition, C= uplift and erosion
- ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition
- ☐ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
- ☒ d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
- ☐ b. Natural processes are the primary cause of the greenhouse effect.
- ☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
- ☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
- ☐ e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☐ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
- ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
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6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
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- ☒ b. Reservoir B has a shorter residence time than Reservoir A.
- ☐ c. Reservoir A and Reservoir B have equal residence times.
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**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
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8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
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☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase  
☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- B ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
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10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- A ☒ a. The Earth's atmosphere would become colder than it is today.  
☐ b. The Earth's atmosphere would become warmer than it is today.  
☐ c. The Earth's atmosphere would remain about the same temperature as it is today.  
☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

mixed up

If there is an increase of atmospheric  $\text{CO}_2$  then more heat will be "trapped" in the Earth's atmosphere & surface, thus warming up the water. The oceans would in turn have a higher pH level. The cold water is more efficient at trapping  $\text{CO}_2$  than warm water, so the larger bodies of water become more acidic. If the oceans then warm-up, they will emit more  $\text{CO}_2$  back into the atmosphere. This is a positive feedback loop since there was an increase in atmospheric  $\text{CO}_2$  which led to even more increase in atmospheric  $\text{CO}_2$ . If the pH were to lower, this would be a negative feedback loop because there would eventually lead to less atmospheric  $\text{CO}_2$ .

10

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

X When a volcano erupts and a large ash cloud is formed, more energy is given off during the formation of these clouds. With the energy being given off temperature would increase. Also, with an increase in clouds, when the sun emits radiation, the clouds act as a barrier and "trap" the infrared light after it has been reflected from the Earth's surface. The greenhouse gases then emit these infrared energy back to the earth, which gets reabsorbed, and a positive feedback cycle takes place. When the ash settles into the earth's surface & in the oceans, more of the sun's visible light will be reflected as opposed to being absorbed. which will decrease atmospheric temperature.

Also, during volcanism, magma rises & erupts, which also increases atmospheric temperature by the formation of rocks, which absorb visible light & heat up the Earth.

15

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

---

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

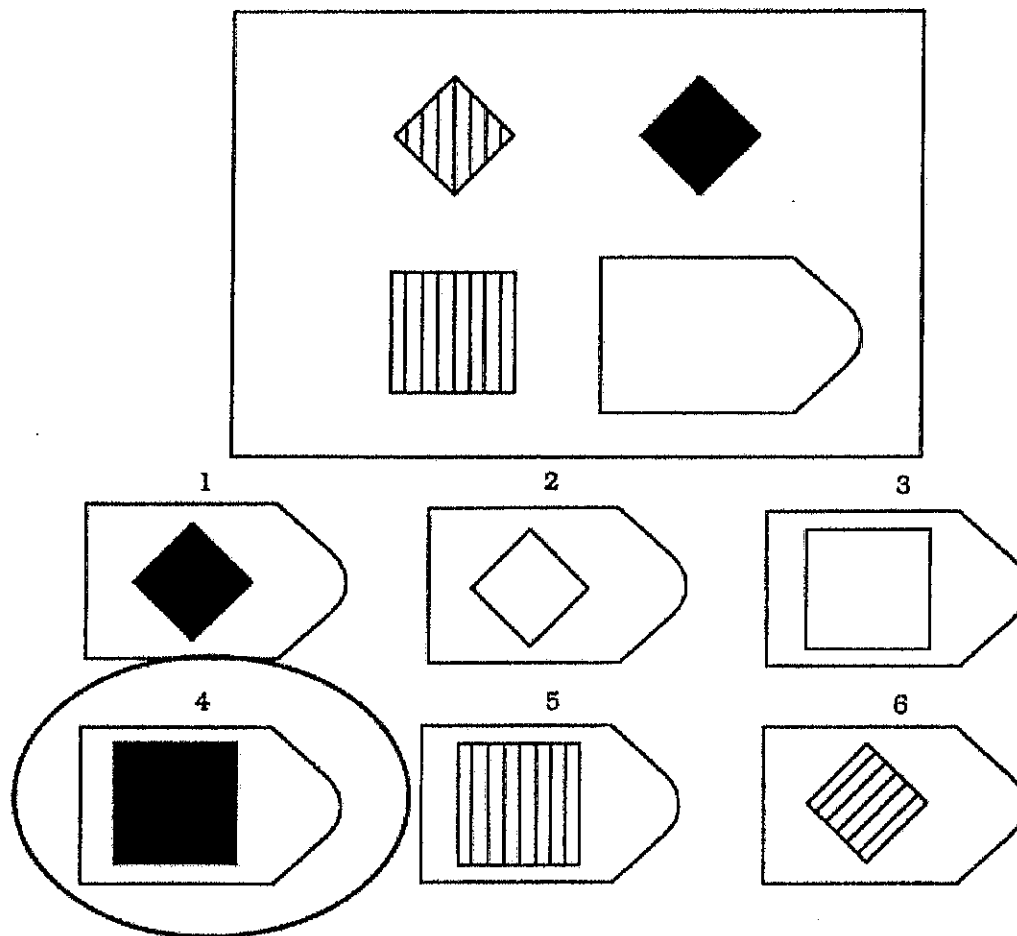
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



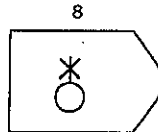
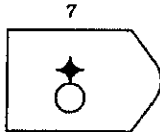
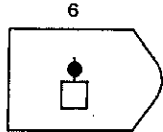
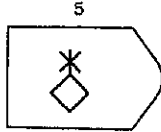
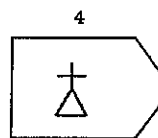
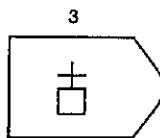
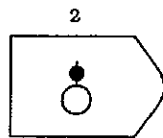
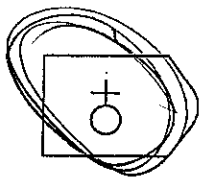
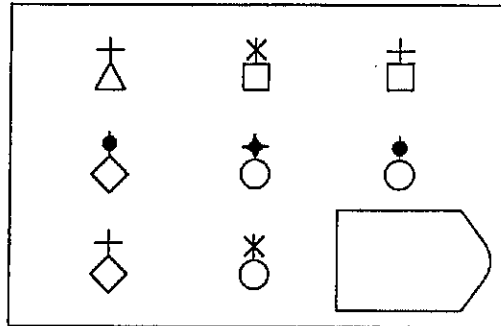
Answer: 4

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Please choose the image that best completes each of the following patterns.

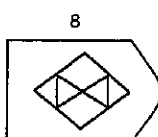
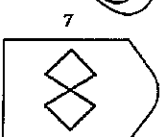
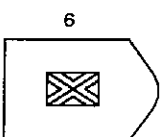
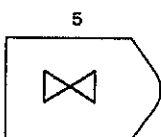
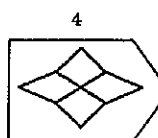
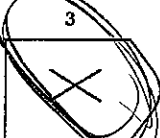
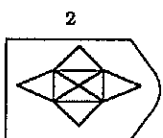
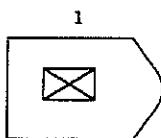
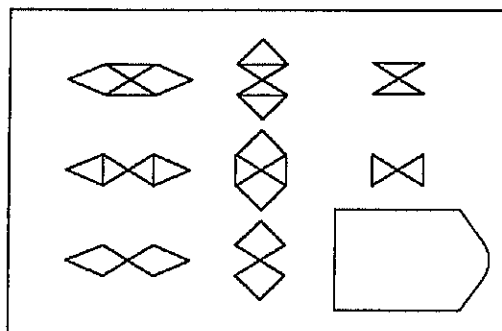
### PATTERN 1

#1



### PATTERN 2

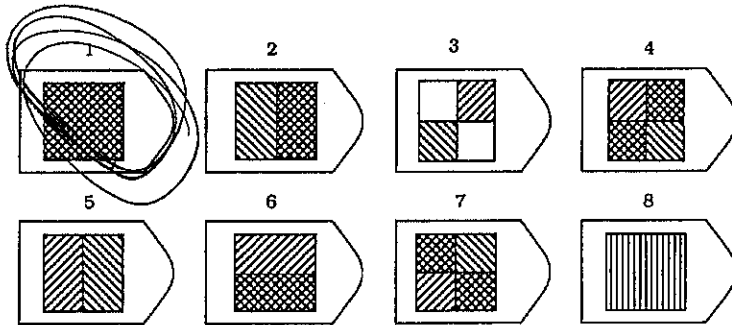
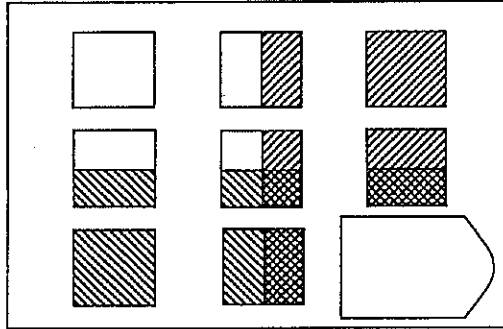
#3



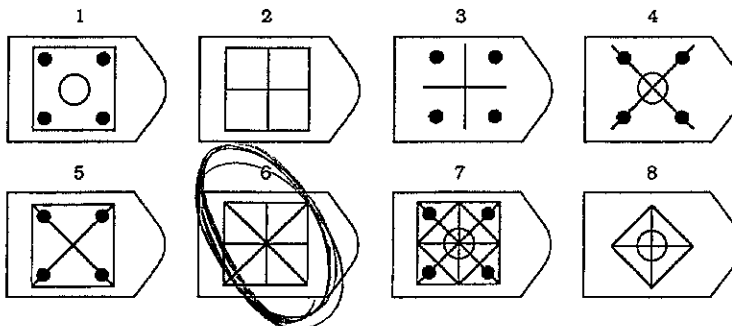
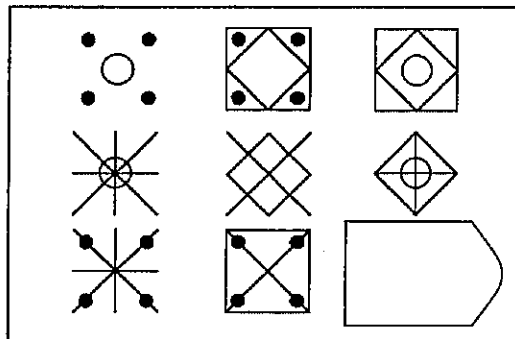


**PATTERN 3**

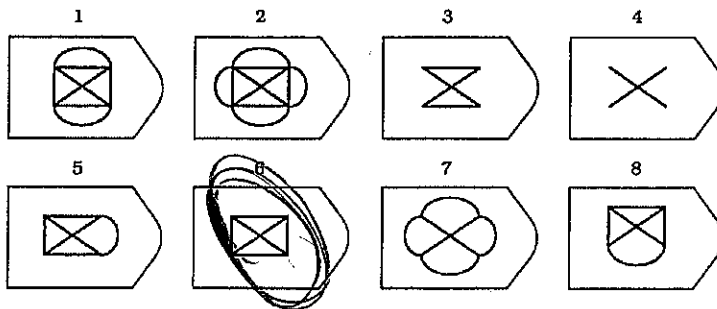
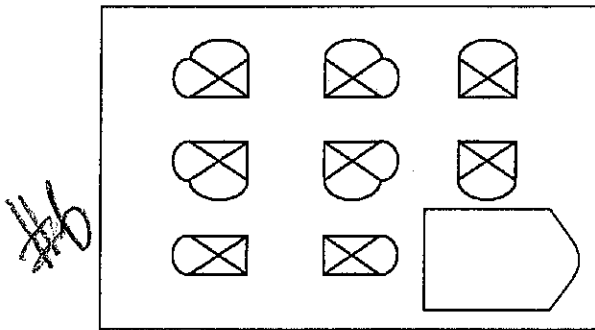
#1

**PATTERN 4**

#6



PLEASE CONTINUE ON NEXT PAGE

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In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- ☐ B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- ☐ C. Blowing bubbles. They are similar because they both float until they eventually pop.
- ☐ D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- ☐ B. Getting pink eye. They are similar because they are both contagious.
- ☐ C. Getting the flu. They are similar because they are both caused by not washing your hands.
- ☐ D. Forgetting to do your homework. They are similar because they are both preventable.
- ☐ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48331

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A43219269  
Version A

GROUP

C14

80

**MULTIPLE-CHOICE. 5 points each (50 points total).**

B 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- a. The magma becoming colder
- b. Gas bubbles forming in the magma
- c. The surrounding crust becoming hotter
- d. Crystals forming in the magma

B 2. Which of the following would be considered a negative feedback to increasing global temperature?

- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
- b. Melting of permafrost resulting in more methane escaping into the atmosphere
- c. An increase in evaporation and cloud formation resulting in the release of latent heat
- d. An increase in desert formation resulting in more dusting blowing into the atmosphere

C 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- a. A= erosion, B= deposition, C= uplift and erosion
- b. A = erosion, B= biochemical precipitation, C= uplift and deposition
- c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
- d. A = dissolution, B= deposition, C= uplift and deposition

B 4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- a. Human activities are the primary cause of the greenhouse effect.
- b. Natural processes are the primary cause of the greenhouse effect.
- c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
- d. Neither human activities nor natural processes are important causes of the greenhouse effect.
- e. The human and natural causes of the greenhouse effect are not understood.

A 5. Which of the following would cause the acidity of Earth's oceans to decrease?   
less CO<sub>2</sub> in ocean ↓ acidity.

- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
- b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
- c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

B 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- a. Reservoir A has a shorter residence time than Reservoir B.
- b. Reservoir B has a shorter residence time than Reservoir A.
- c. Reservoir A and Reservoir B have equal residence times.
- d. More information about Reservoir A and Reservoir B is needed.

$$R/T = \frac{\text{Size A}}{\text{Rate}} \uparrow$$

B

- B
7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of 100 km/year and an outflow of 50 km/year. Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- C
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☒ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- C
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- A
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

positive clouds  $\rightarrow$  <sup>water</sup> evaporation  $\rightarrow$  Green Gas  $\rightarrow$   $\uparrow T$

negative clouds  $\rightarrow$  block solar energy  $\rightarrow$   $\downarrow T$

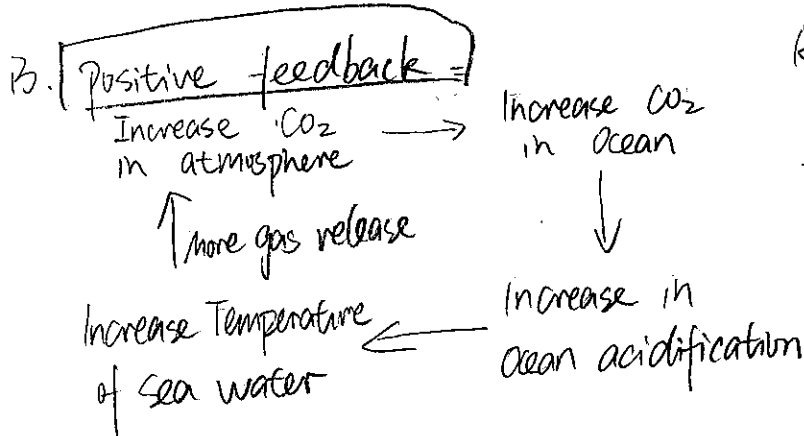
SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

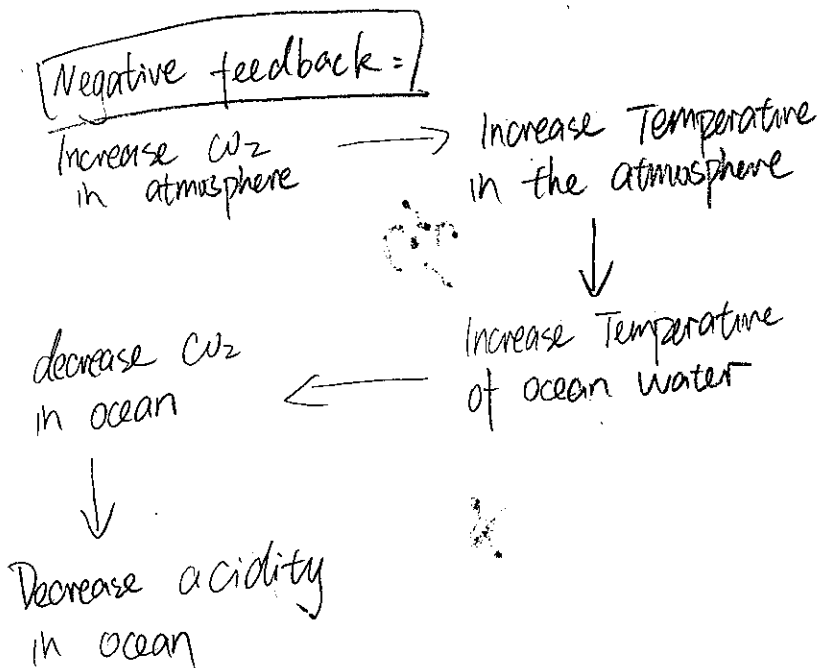
Your answer should include:  $\text{CO}_2 \uparrow \rightarrow \text{acidification}$ .

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

A. Ocean acidification occurs when  $\text{CO}_2$  dissolve in water and interact with water. If the carbon dioxide in atmosphere increases which means more  $\text{CO}_2$  would dissolve in water, that leads to an increasing  $\text{CO}_2$  in ocean. As more  $\text{CO}_2$  interact with water molecules in the ocean, the pH of ocean would increase as well. As a result, there is an increase in ocean acidification.



As the  $\text{CO}_2$  increases in atmosphere, the  $\text{CO}_2$  in ocean increases as well, and the pH of ocean increase. More chemical energy released when  $\text{CO}_2$  interact with  $\text{H}_2\text{O}$ , increasing temperature of water cause more  $\text{CO}_2$  freeze out. And  $\text{CO}_2$  in atmosphere increase again. This a positive feedback.



Due to greenhouse effect, increasing  $\text{CO}_2$  leads to increasing temperature in the atmosphere. And increase temperature of ocean water. But this leads to a decrease  $\text{CO}_2$  in ocean. As a result, decrease acidity in ocean. This is a negative feedback.

OK

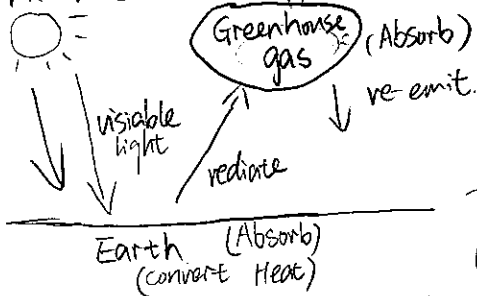
25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

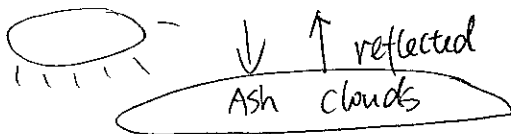
A. Greenhouse effect =



As it shows from the picture, when the solar radiation enter into the earth, the visible wavelength can go through the atmosphere easily. when it reaches earth ground, the light are absorbed and converted to infrared or heat.

And heat are radiated to the atmosphere. Greenhouse gas is a good absorber for the infrared light. In the atmosphere, some part of the heat will be absorbed by greenhouse gas, and some will be re-emitted to the ground. And these re-emitted infrared radiation continue to undergo the re-emitting process from all directions.

We assume volcanism increases dramatically, large ash clouds will be produced. These ash clouds will block the solar radiation from the sun. It means less visible light can come through the atmosphere and enter into the earth. Under this situation, less radiation will be converted into infrared radiation or heat. Most of these visible light will be reflected back to space. As a whole the atmospheric temperature will decrease.



25

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Similar = Less energy will be released during  
Different = Evaporation = liquid into gas.

and they are both process. both chemical energy driven process.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

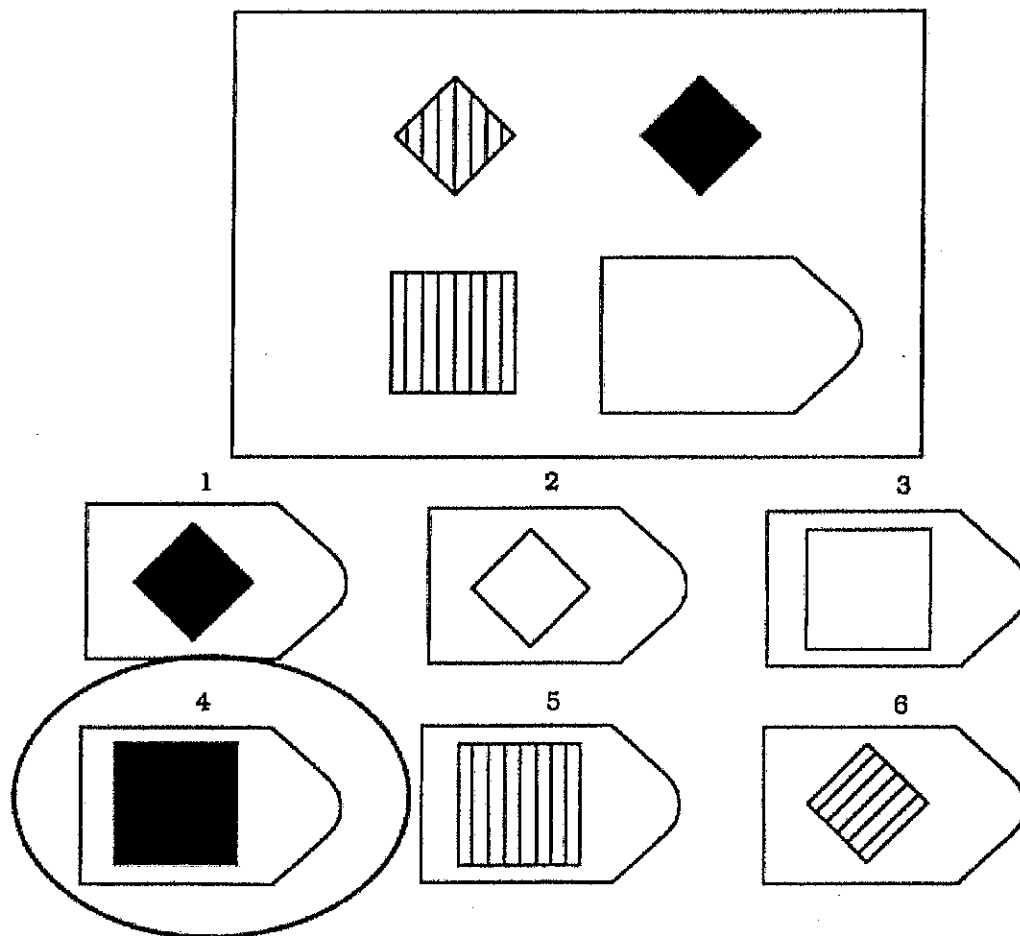
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

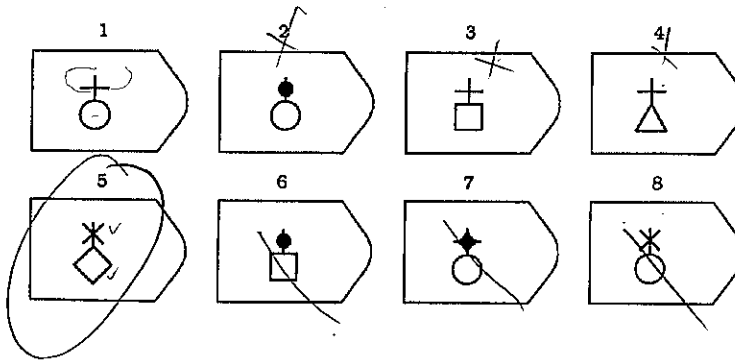
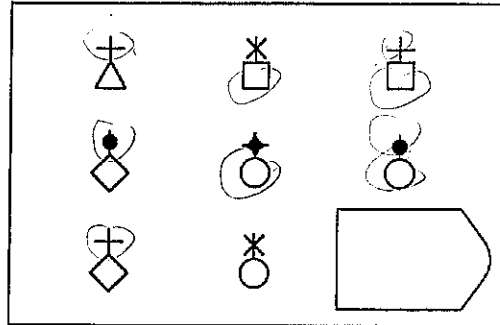


**Answer: 4**

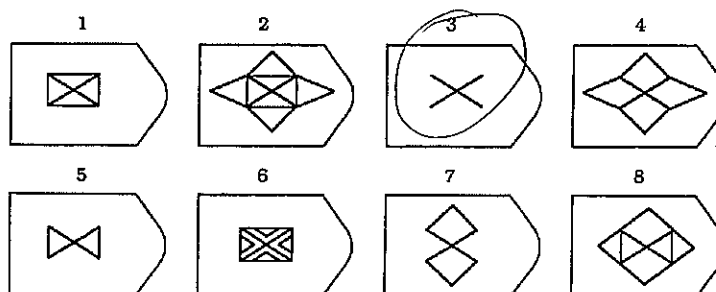
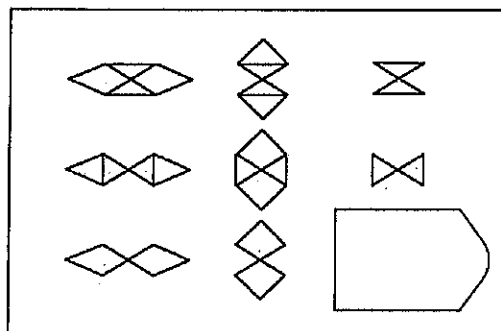
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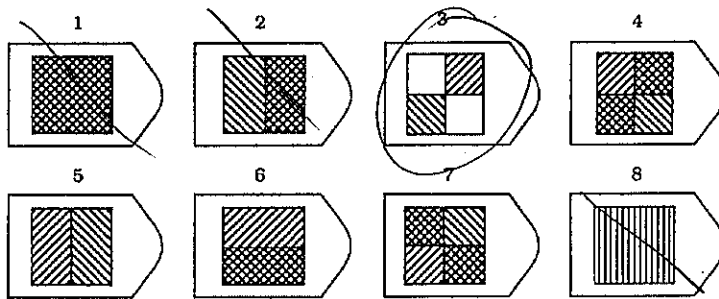
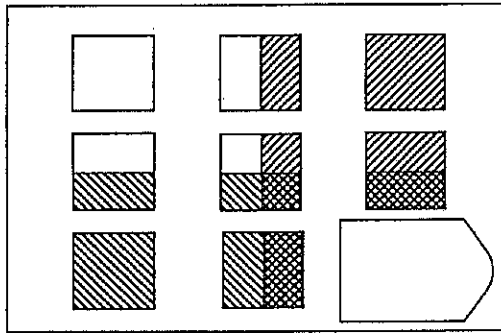
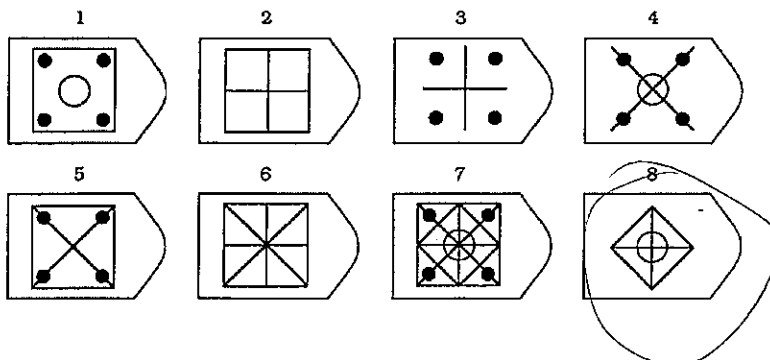
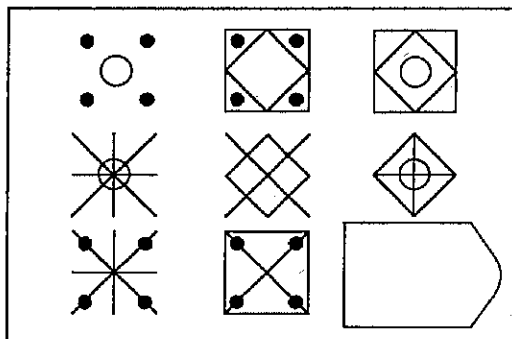
Please choose the image that best completes each of the following patterns.

### PATTERN 1

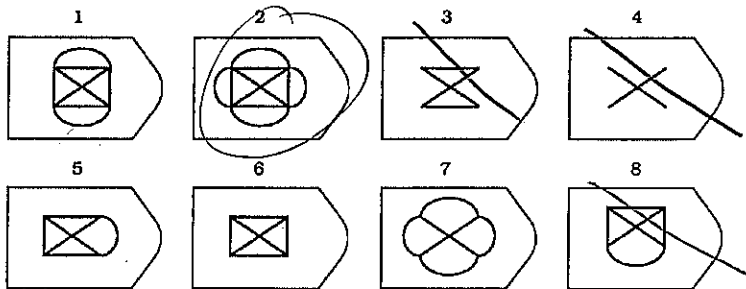
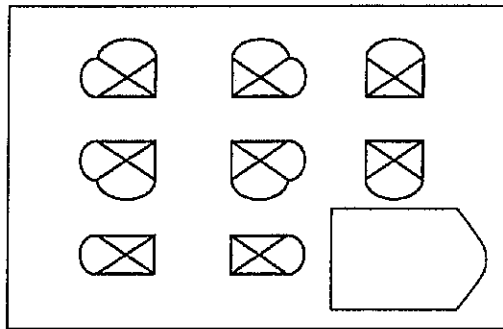


### PATTERN 2



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

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C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

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B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

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D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

☒ C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
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- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48823

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☒ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A40041748  
Version B

GROUP: C15

70

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - ☒ a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
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  - ☒ c. A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - d. A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - ☒ a. Human activities are the primary cause of the greenhouse effect.
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  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
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5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
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RT =
6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ☐ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☐ a. The Earth's atmosphere would become colder than it is today.
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  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
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  - ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification occurs when  $\text{CO}_2$  from the atmosphere dissolves into the ocean. This combination of  $\text{CO}_2 + \text{H}_2\text{O}$  results in more  $\text{HCO}_3^- + \text{H}^+$  ions in the ocean, making the pH balance more acidic. ✓

Negative feedback loops are when an event causes ~~more~~ of the same event. If there is an increase in  $\text{CO}_2$  in the oceans there is an increase in ocean acidification

Positive: increase in atmospheric  $\text{CO}_2$  increases acidification and also atmospheric temp. because of the strengthened greenhouse effect. However, as atmospheric temp. increases, so does evaporation & cloud formation. Clouds partially block the sun which causes decrease in ocean temp. Colder oceans don't absorb  $\text{CO}_2$  as well, but still do, so although it is still occurring, it is not as fast as expected

~~15~~

15

not clear

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect is how the earth's atmosphere is heated due to absorption & re-emittance of visible light as infrared radiation. The sun emits visible light which enters the atmosphere and is either reflected off of surfaces like glaciers and bounced back into space, or it is absorbed and re-emitted by the earth and released as infrared radiation. This then can either bypass the greenhouse gases that surround the atmosphere, thus causing no heating, or is re-absorbed and emitted by greenhouse gases back to the atmosphere. This continual absorption & re-emittance is what heats the atmosphere. If volcanism dramatically increased, and large ash clouds were produced, the ash would remain in the atmosphere. This would partially block visible light from the sun from entering the atmosphere. Because of this less visible light would be absorbed and re-emitted to the atmosphere, and the greenhouse effect would be weakened. Causing the atmospheric temperature to decrease.

25

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

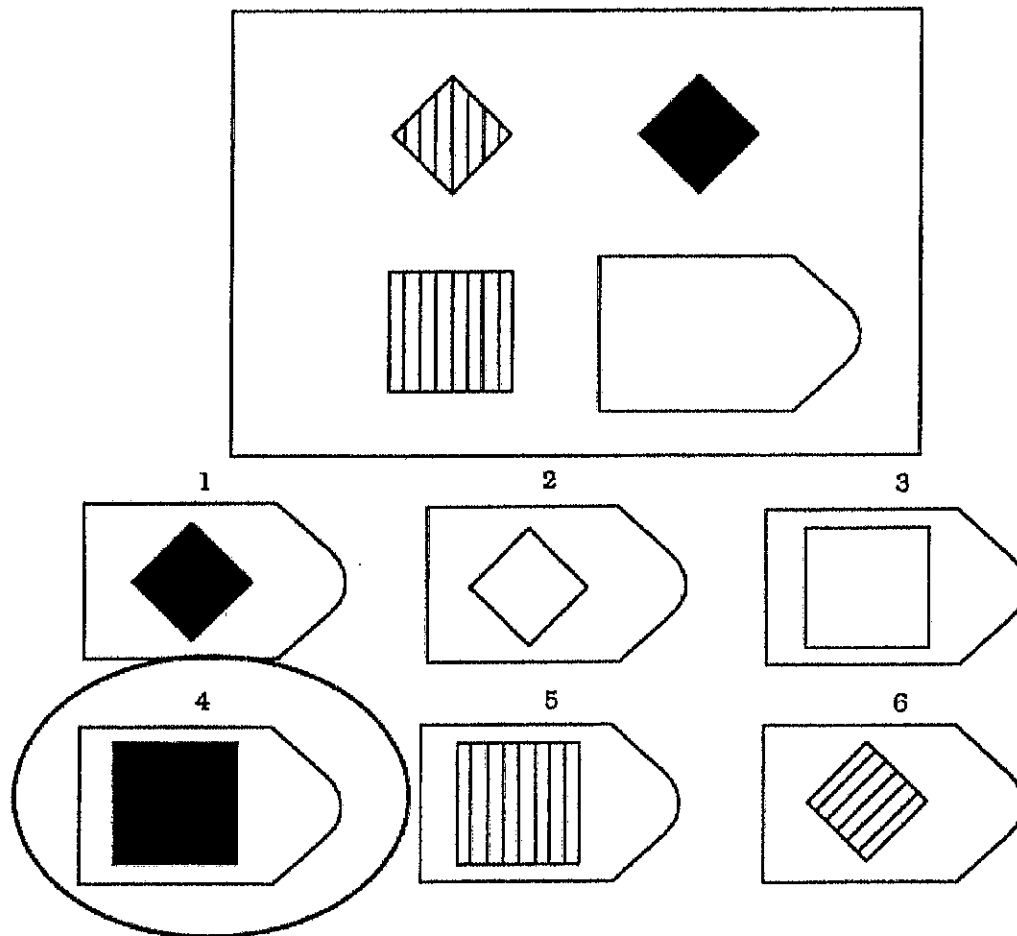
**Thoughtfully complete the attached survey**



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*Example*

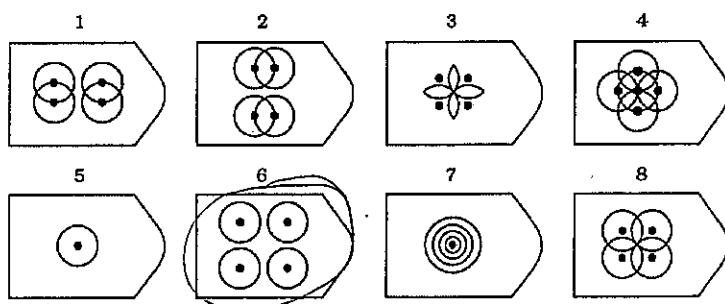
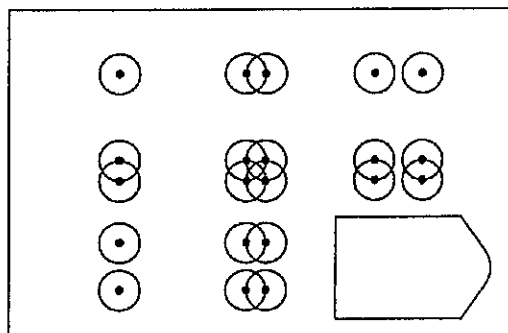


**Answer: 4**

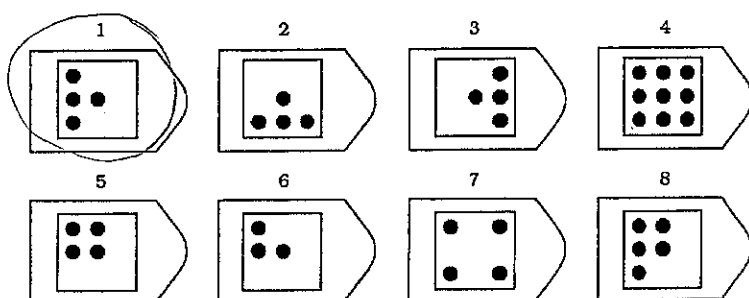
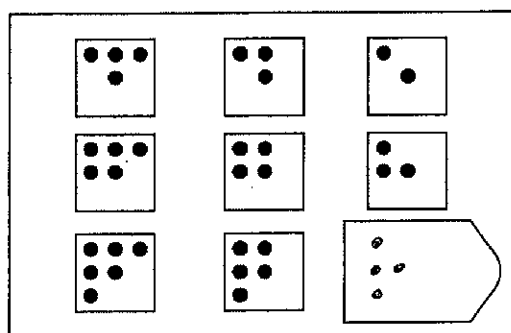
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

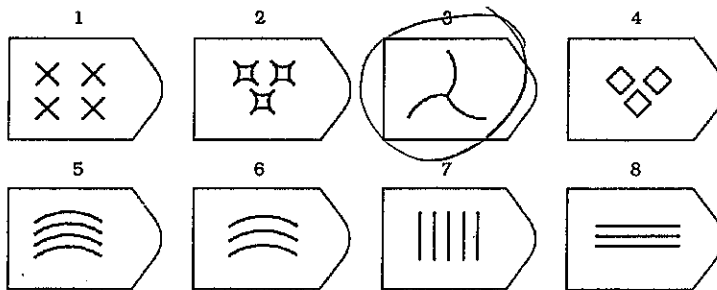
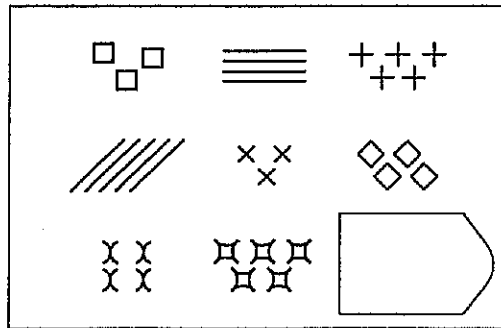
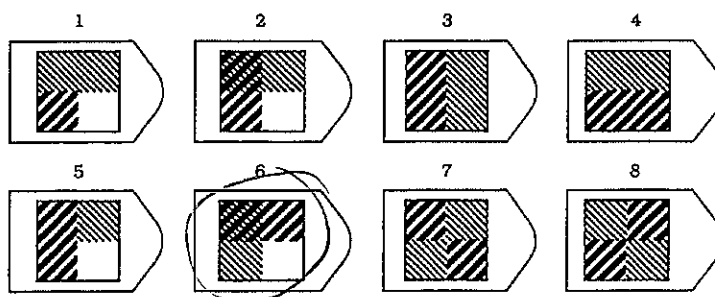
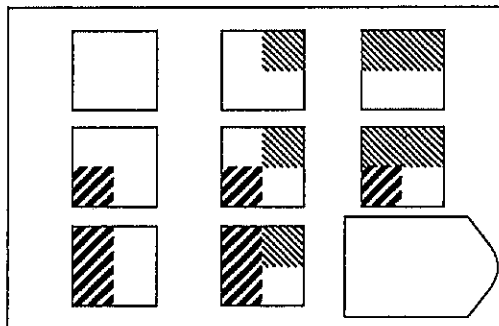
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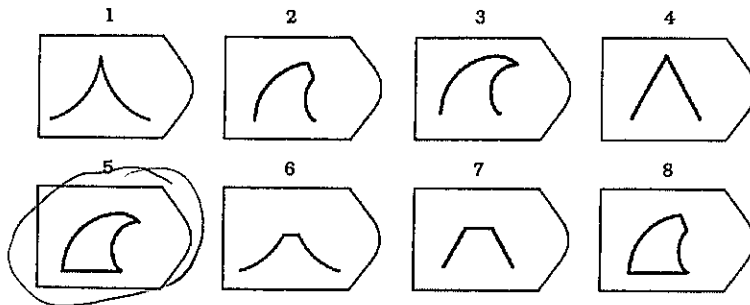
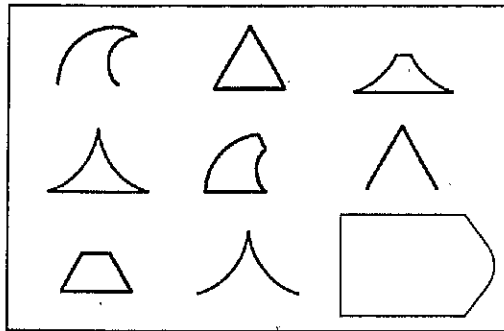


### PATTERN 2





**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

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D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

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D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

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- 

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## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48306

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A41021960  
Version B

GROUP: C15

73

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- X
- B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

Temp ↑

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in the amount of atmospheric carbon dioxide will lead to greater ocean acidification. This happens because when  $\text{CO}_2$  comes into contact with the hydrosphere, dissolution, a bicarbonate is produced. Attached to these <sup>through</sup> are hydrogen atoms which make the ocean more acidic.

25

This is an example of positive feedback because an increase in  $\text{CO}_2$  in the atmosphere ultimately leads to an increase in  $\text{CO}_2$  in the ocean which produces greater acidification. It is important to note that the colder the ocean water is, the more  $\text{CO}_2$  it can hold which leads to greater acidification. The reason for this is because the molecules are moving slower than they would be in warmer water. The principle of temperature tells us that it is a measurement of how fast the molecules are moving.

Negative feedback loops happen when one event eventually leads to the opposite event occurring later on. For example, the earth's atmosphere heats up which causes an increase in evaporation. This increase in evaporation leads to more water in the atmosphere which produces more clouds. The clouds then reflect incoming sunlight which produces more clouds. It is this in the cooling of the earth's atmosphere which

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

During volcanism, large amounts of  $\text{CO}_2$  are emitted into the earth's atmosphere. This large amount of  $\text{CO}_2$  <sup>(volcanic degassing)</sup> turns into an ash cloud that can cover the earth's surface. This large ash cloud restricts the amount of visible light that can break through the cloud cover and eventually either be absorbed or reflected by the earth's surface. Much of this visible light is reflected back into space once coming into contact with the ash cloud cover. Because there is less infrared rays being emitted from earth's surface, under normal conditions, infrared rays would be emitted from the earth's surface and would come into contact with greenhouse gasses ( $\text{CO}_2$ , Methane, etc.), these gasses would then become excited and start re-emitting these rays in all directions, creating a warmer atmosphere. The earth's atmosphere will be experiencing a gradual decrease in temperature.

23

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is the change from liquid to gas.  
degassing is the transition from liquid to gas in water



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

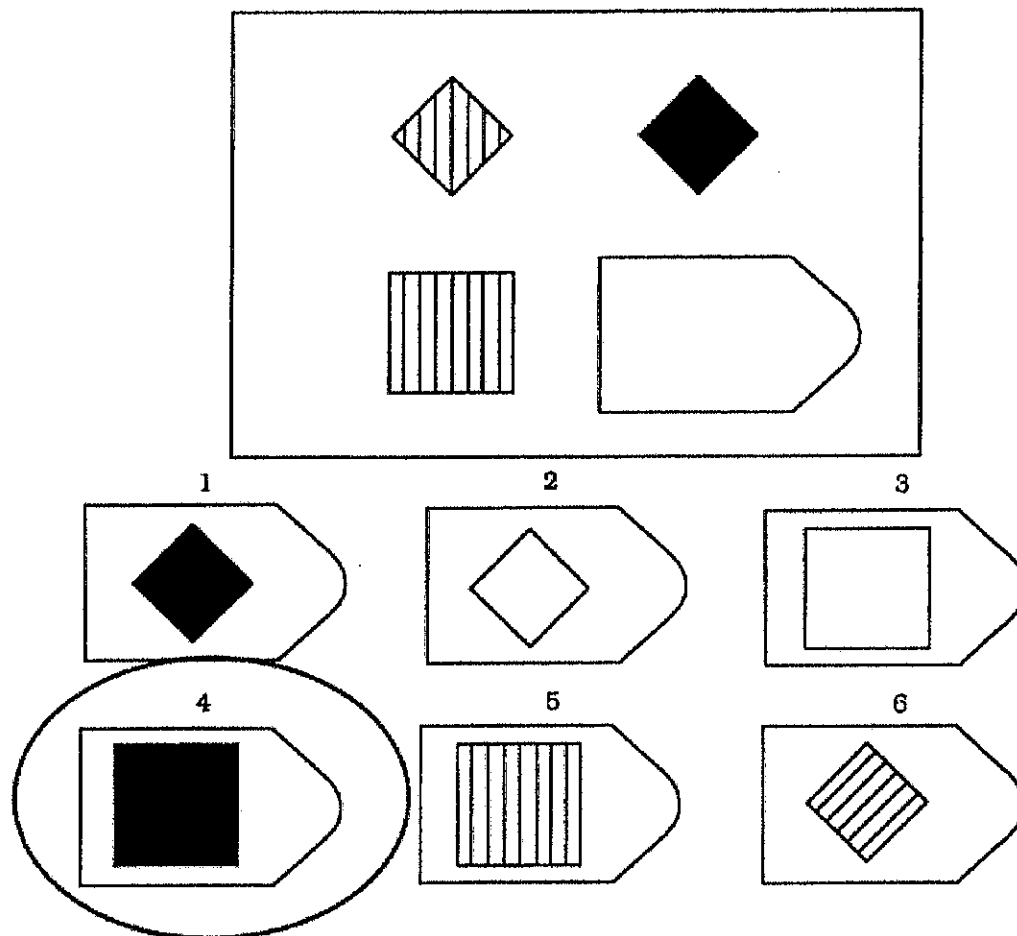
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

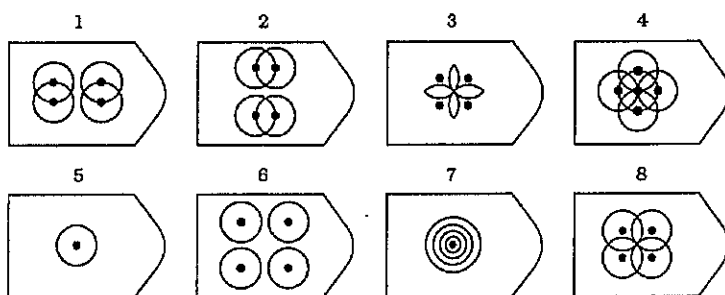
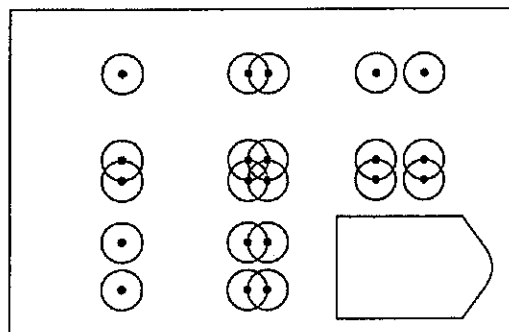
*Example*



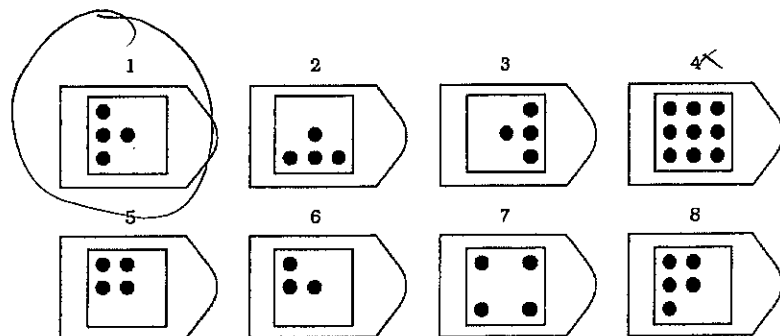
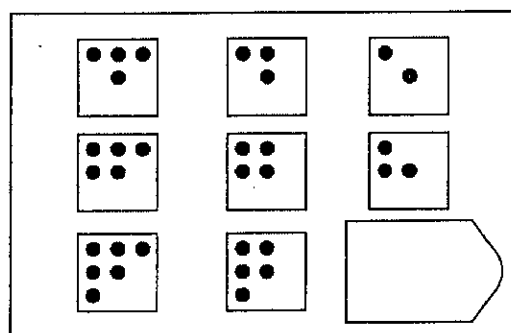
Answer: 4

Please choose the image that best completes each of the following patterns.

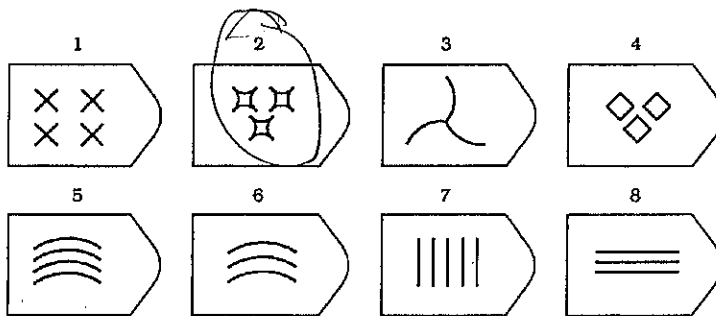
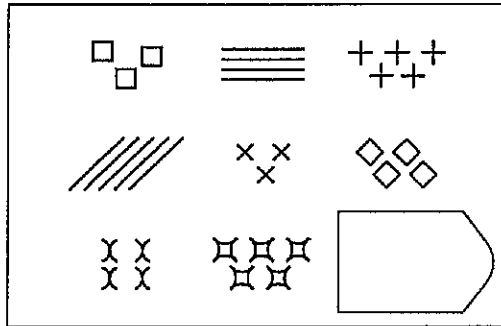
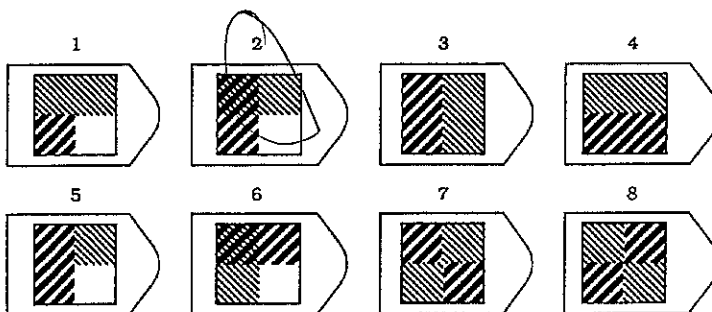
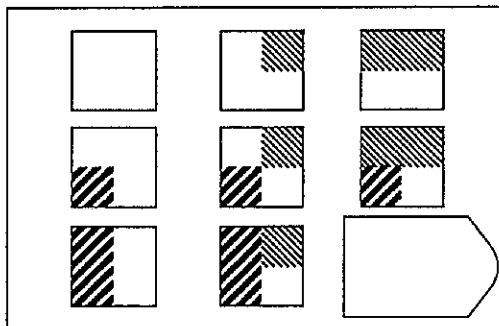
### PATTERN 1

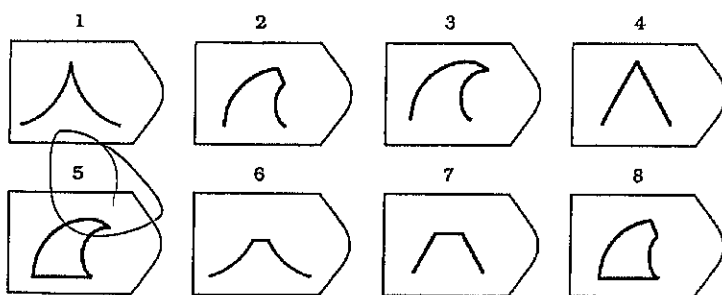
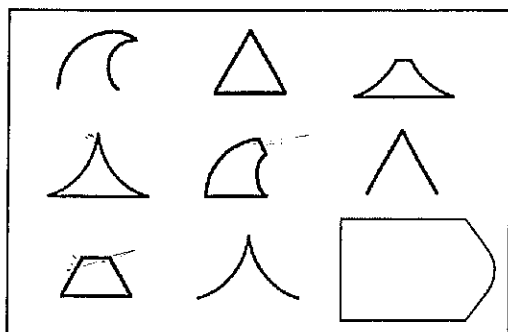


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

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In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

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- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A 40945005  
Version B

GROUP: C15

1  
17

**MULTIPLE-CHOICE. 5 points each (50 points total).**

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- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

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  - The reservoir is not in equilibrium.
  - The reservoir is growing smaller.
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## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

10 { Ocean acidification is dependent on the Carbon dioxide in the atmosphere. When the  $\text{CO}_2$  increases in the atmosphere so does the ocean's acidification. When it decreases the ocean acidification does too.

The more acidity in the oceans are not good. When the pH levels are higher the fish living in the ocean would not survive. This would affect the amount of seafood there is to eat. It is good to keep the levels balanced. As long as the  $\text{CO}_2$  in the atmosphere is under control the pH levels should be controllable.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

A- The greenhouse effect is the sun warming the atmosphere. IF volcanism is increased then the atmosphere may be warmer than usual.

2 • The temperature could increase if the heat is absorbed into the atmosphere. The only way it would decrease is if it is being reflected or if it is blocked.

B- If volcanism increases, large ash clouds will block the sun's rays from the atmosphere. If more volcanoes erupt and produce more clouds then the atmospheric temp. will be lower. Also if ashes are covering the atmosphere the heat would not be absorbed.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation happens when a liquid becomes a gas.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

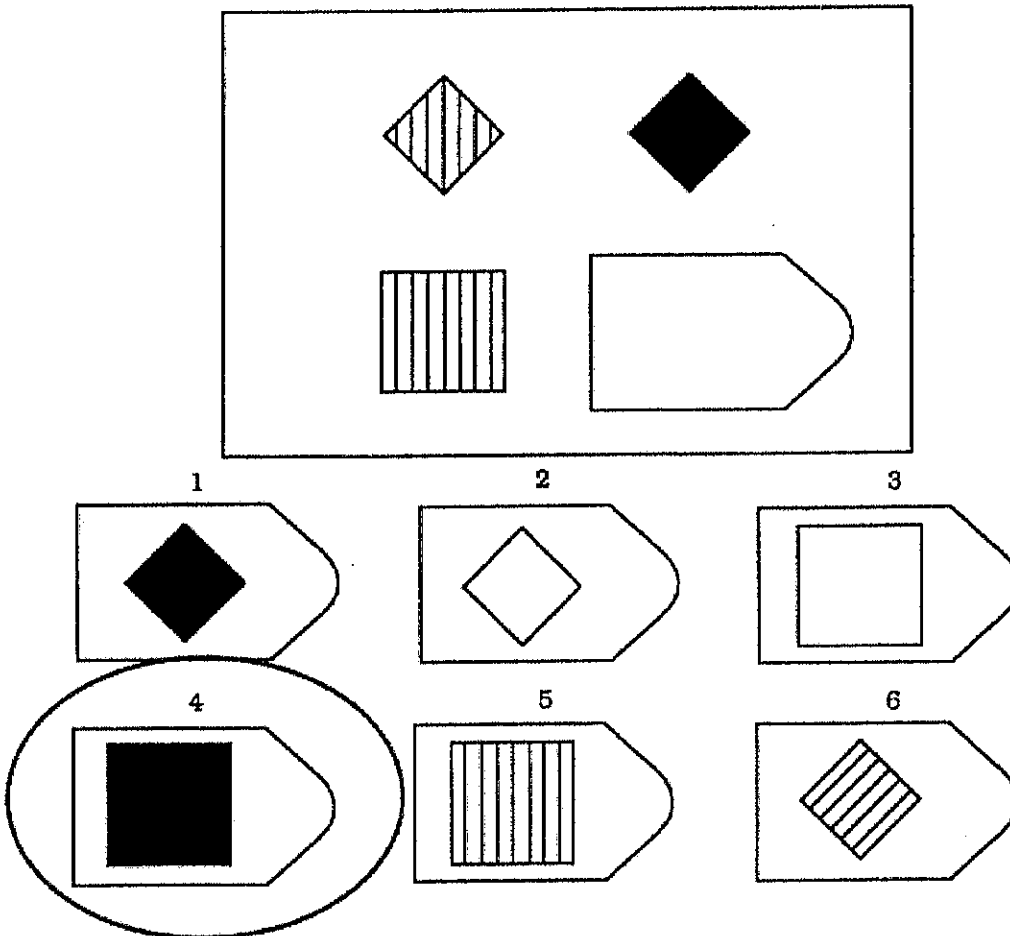
**Thoughtfully complete the attached survey**



# Analogical Assessment

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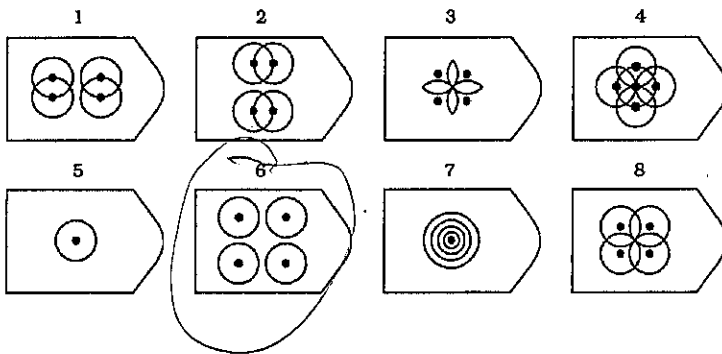
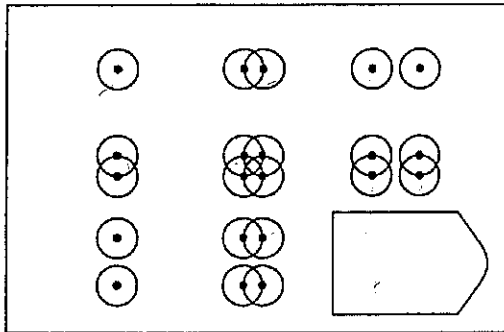
*Example*



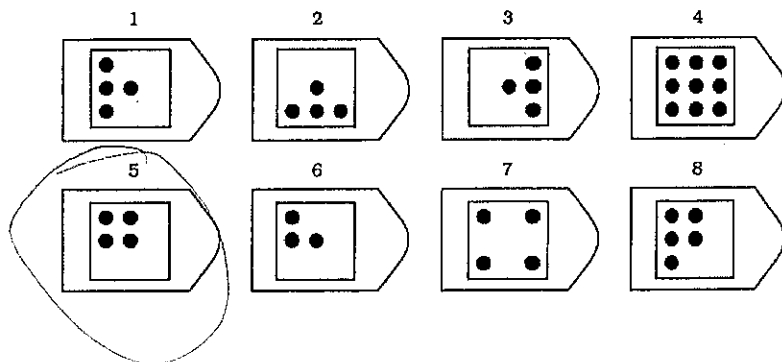
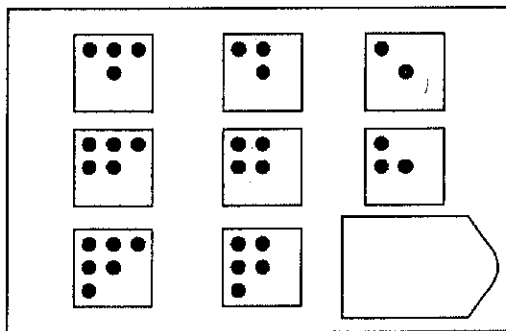
**Answer: 4**

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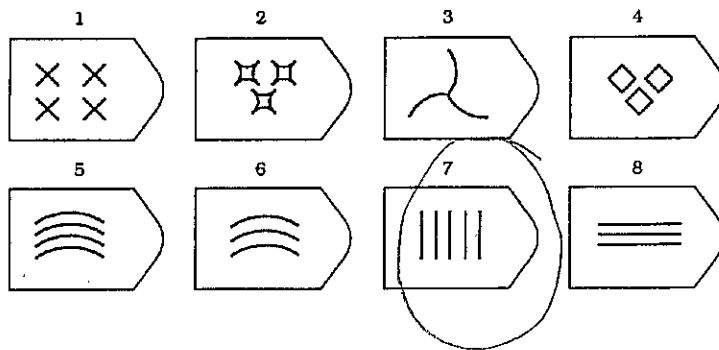
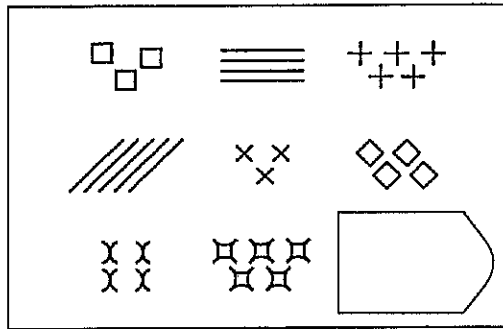


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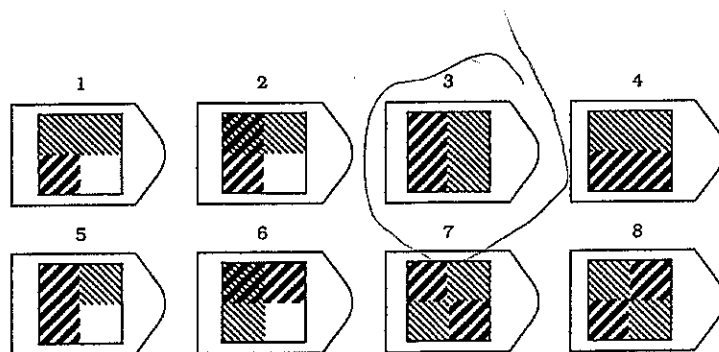
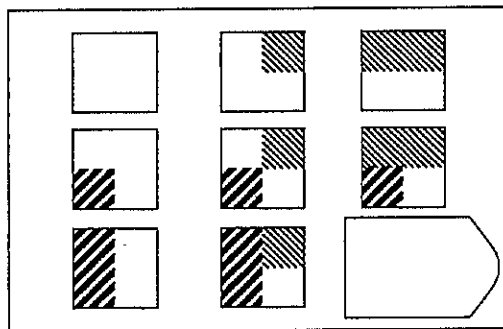


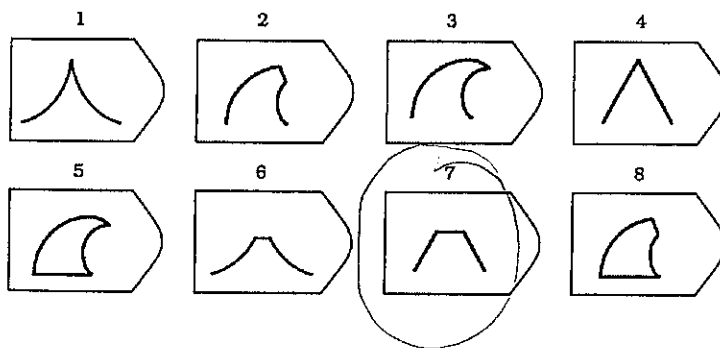
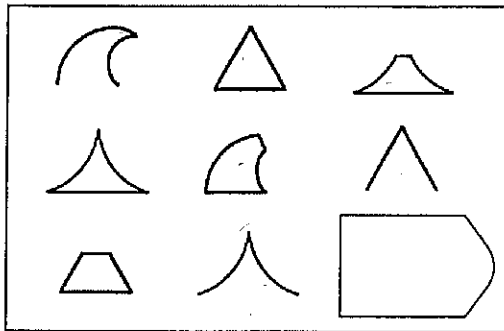


**PATTERN 3**



**PATTERN 4**



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In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

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- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

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- ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48823

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☒ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: \_\_\_\_\_

Version B


GROUP: \_\_\_\_\_

C15

A42669701

60

MULTIPLE-CHOICE. 5 points each (50 points total).

- C 1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ An increase in evaporation and cloud formation resulting in the release of latent heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
- D 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - ☒ Crystals forming in the magma
- D 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of \_\_\_\_A\_\_\_\_. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of \_\_\_\_B\_\_\_\_ and compaction, and then limestone becomes exposed at Earth's surface through the processes of \_\_\_\_C\_\_\_\_.
- A= erosion, B= deposition, C= uplift and erosion
  - A= erosion, B= biochemical precipitation, C= uplift and deposition
  - A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - ☒ A= dissolution, B= deposition, C= uplift and deposition
- B 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - ☒ Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
- B 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A. 
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
- A 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- D 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- A 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- B 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ~~a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.~~
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ~~c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.~~
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

↑ atm. CO<sub>2</sub> , ↑ ocean temp. → <sup>3</sup> to ΔpH<sub>ocean</sub>

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase of atmospheric carbon dioxide will increase the amount of greenhouse gases. This will cause more IR heat to be absorbed by these GH gases. The rays that travel from the sun to Earth are of an invisible wavelength that which is emitted from Earth's surface is infrared wavelength. The increased absorption of heat will cause the atmospheric temperature to rise, thus causing an increase in the ocean temperature.

Increased ocean temp. will cause an increase in the acidity of the ocean. This is because a chemical reaction  $[\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+]$  will be affected by the increase in <sup>ocean</sup> temp.: the rate at which the reaction occurs will increase. The interaction of  $[\text{CO}_2]$  and  $[\text{H}_2\text{O}]$  causes a chemical reaction that results in the products of  $[\text{HCO}_3^-]$  and  $[\text{H}^+]$ , which increases the acidity (pH) of the ocean. (G.H.)

An increase in atmospheric CO<sub>2</sub> will cause more absorption of heat; this will cause the temperature of both the atmosphere and ocean to increase. The interaction of the ocean and atmosphere (H<sub>2</sub>O + CO<sub>2</sub>) causes a reaction that increases the acidity of the ocean. Increased ocean + atmosp. temp. causes the rate at which the chemical reaction occurs to increase, i.e. increase in acidity of ocean

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

4

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Effect of increased volcanism (particularly w/ large ash clouds) on Atmospheric Temperature

Increased volcanism, i.e. more ash spewed into the atmosphere, will ~~not~~ cause more solar radiation to be reflected, and less being absorbed by the Earth. Less solar radiation absorbed will cause a decrease in atmospheric temperature.

Also, this volcano would be spewing magma of andesite, which is less sticky than basalt and causes a more dangerous eruption.

chemical reaction involving andesite releases greenhouse gases. ~~CO<sub>2</sub>~~ This causes an increase of the Greenhouse effect: solar radiation of an (in)visible wavelength is reflected from the Earth as IR waves (thermal energy / heat). The effect of G.H. gases is to increase the amount of heat (reflected from Earth) that is retained in the atmosphere. **7 explain**

change of composition of atmosphere → ↑ G.H. gases → ↑ atmospheric temperature

15

**Extra credit (2 points).**

How are evaporation and degassing similar and/or different? — The type of energy that causes each.  
Evaporation is a change/shift of matter caused by thermal energy (the sun); while degassing is caused by a chemical energy.



Earn up to 1 additional point on your course grade

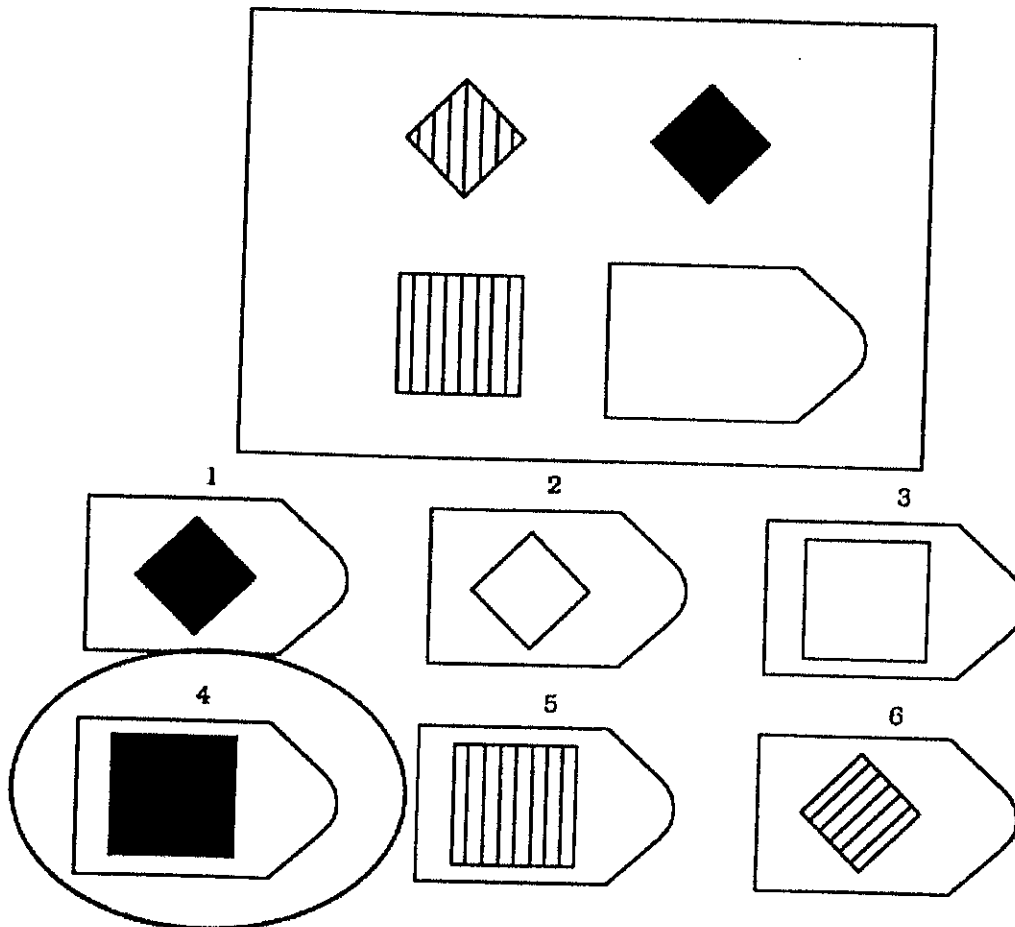
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

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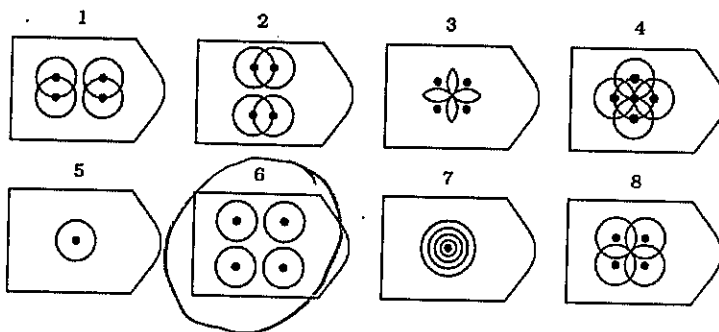
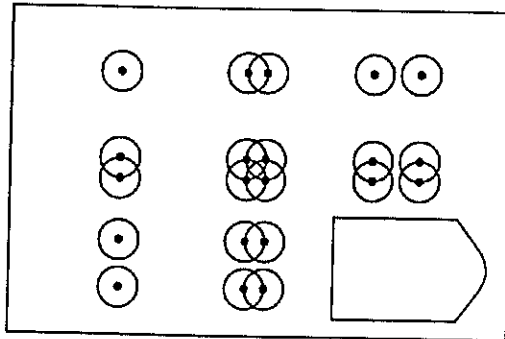


**Answer: 4**

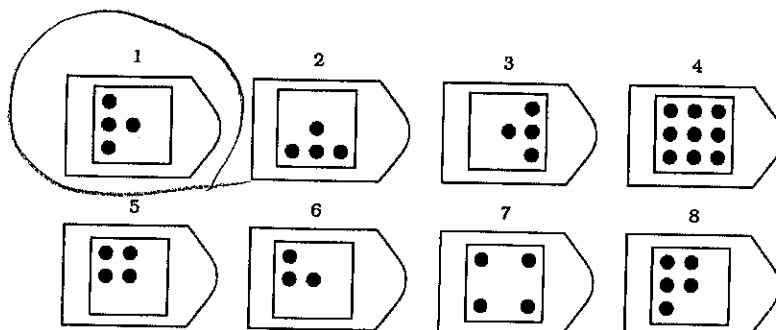
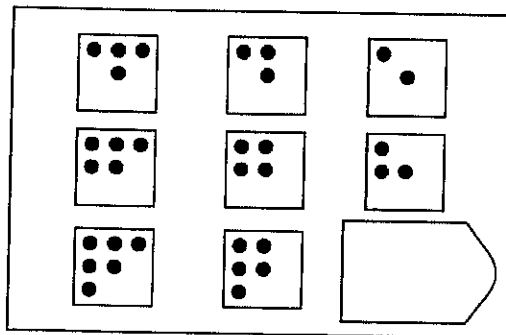
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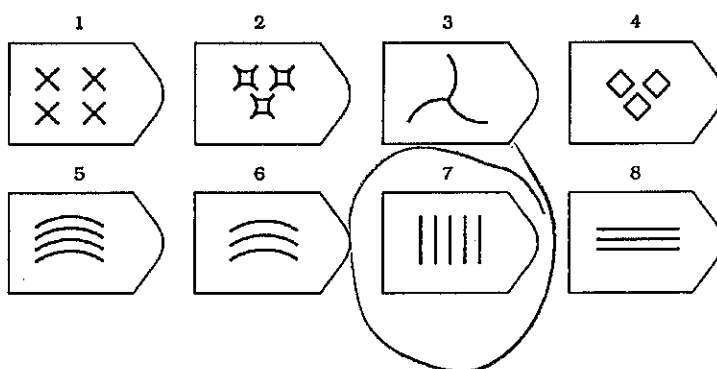
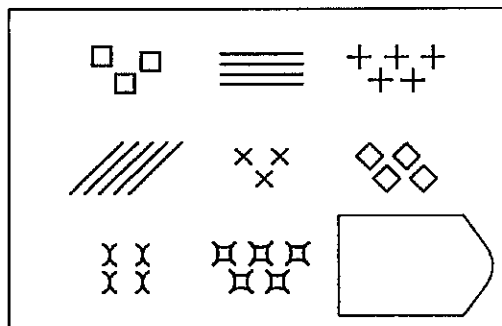
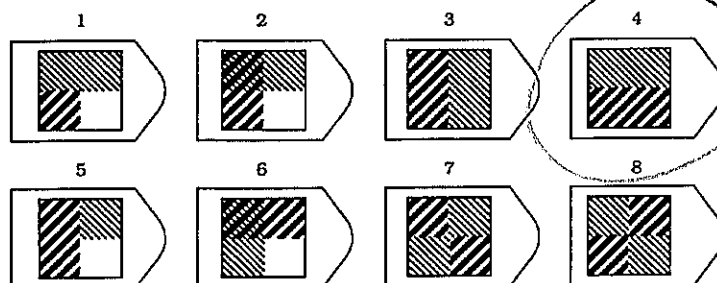
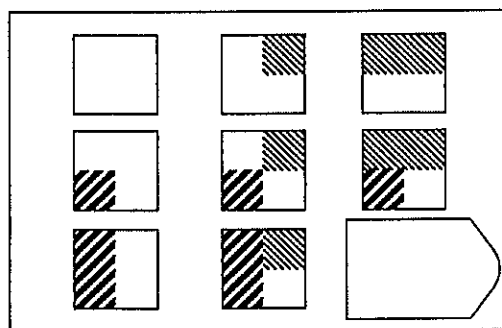
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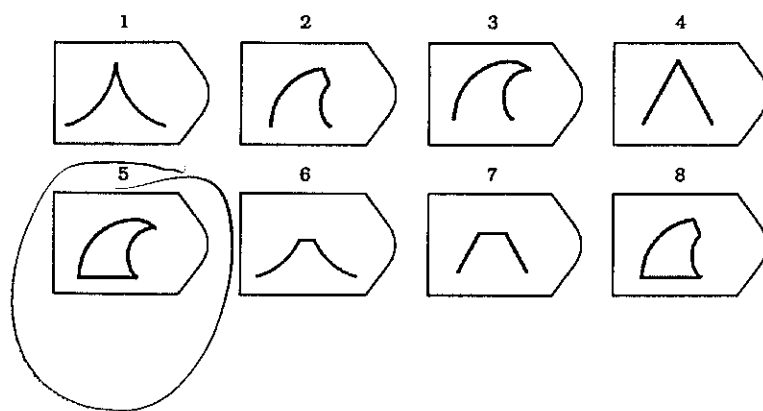
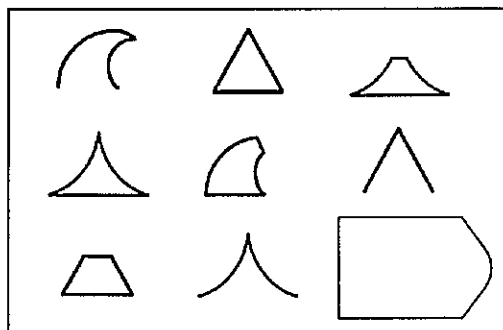


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

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## DEMOGRAPHICS

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What is your home zip code? 48048

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other